SCHOOL OF
CIVIL ENGINEERING

INDIANA
DEPARTMENT OF HIGHWAYS

JOINT HIGHWAY
RESEARCH PROJECT
JHRP-85-15

ENGINEERING SOILS MAP OF HUNTINGTON COUNTY, INDIANA

Edward M. Gefell

PURDUE UNIVERSITY

Final Report

ENGINEERING SOILS MAP OF HUNTINGTON COUNTY, INDIANA

TO: H. L. Michael, Director
Joint Highway Research Project

August 28, 1985

Project: C-36-51B

FROM: Robert D. Miles, Research Engineer
Joint Highway Research Project

File: 1-5-2-76

The attached final report entitled "Engineering Soils Map of Huntington County, Indiana" completes a portion of the long-term project concerned with the development of a county engineering soils map of the 92 counties of the State of Indiana. This is the 76th report of the series. The report was prepared by Edward M. Gefell, Research Associate, Joint Highway Research Project.

Mr. Gefell developed the engineering soils map using aerial photographs, available literature, available soil borings, and limited field studies. Generalized soil profiles of the major soils of each land form-parent material area are presented on the engineering soils map included. The map and report should be useful in planning and developing engineered facilities in Huntington County.

Sincerely,

Robert D. Miles

Robert D. Miles, P.E.
Research Engineer

RDM:ms

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by

Edward M. Gefell
Research Associate

Joint Highway Research Project

Project No.: C-36-51B

File No.: 1-5-2-76

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Engineering Experiment Station
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Purdue University
West Lafayette, Indiana

August 28, 1985

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The author wishes to express his sincere gratitude to Professor Harold L. Michael, Director, Joint Highway Research Project and to the other members of the Project Board for their continued support of the engineering soil mapping project. Special thanks goes to Professor Robert D. Miles for his advice, guidance, and editing of the report. The author acknowledges the drafting effort of Xiaogong Wang and the word processing capabilities of Rita Pritchett.

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INTRODUCTION

The Engineering Soils Map of Huntington County, Indiana (see Figure 1) was developed primarily by interpretation of 1937 aerial photographs using accepted principles of observation and deductive reasoning (1)*. A photomosaic of the county was assembled and land form - parent material associations were delineated by stereoscopic inspection. Available literature, particularly the Soil Conservation Service (SCS) publication "Soil Survey of Huntington County" (2), and topographic, drainage, bedrock and glacial maps as well as roadway soil survey borehole data were referred to while making soil boundary adjustments on the photomosaic. The scale of the aerial photographs used in this project, which were purchased from the United States Department of Agriculture, was approximately 1:20,000. A photomosaic of Huntington County is shown in Figure 2.

A one-day field trip was taken to the county to check soil boundaries, correlate surface soil textures with airphoto patterns observed in the laboratory and resolve ambiguous details. Soil boundaries were modified as necessary according to observations made and soil samples examined in the field. The soil samples taken extended to a depth of approximately 3.5 feet and were used to determine the nature of the surface and subsoils

* Note: Numbers in parenthesis footnote references.

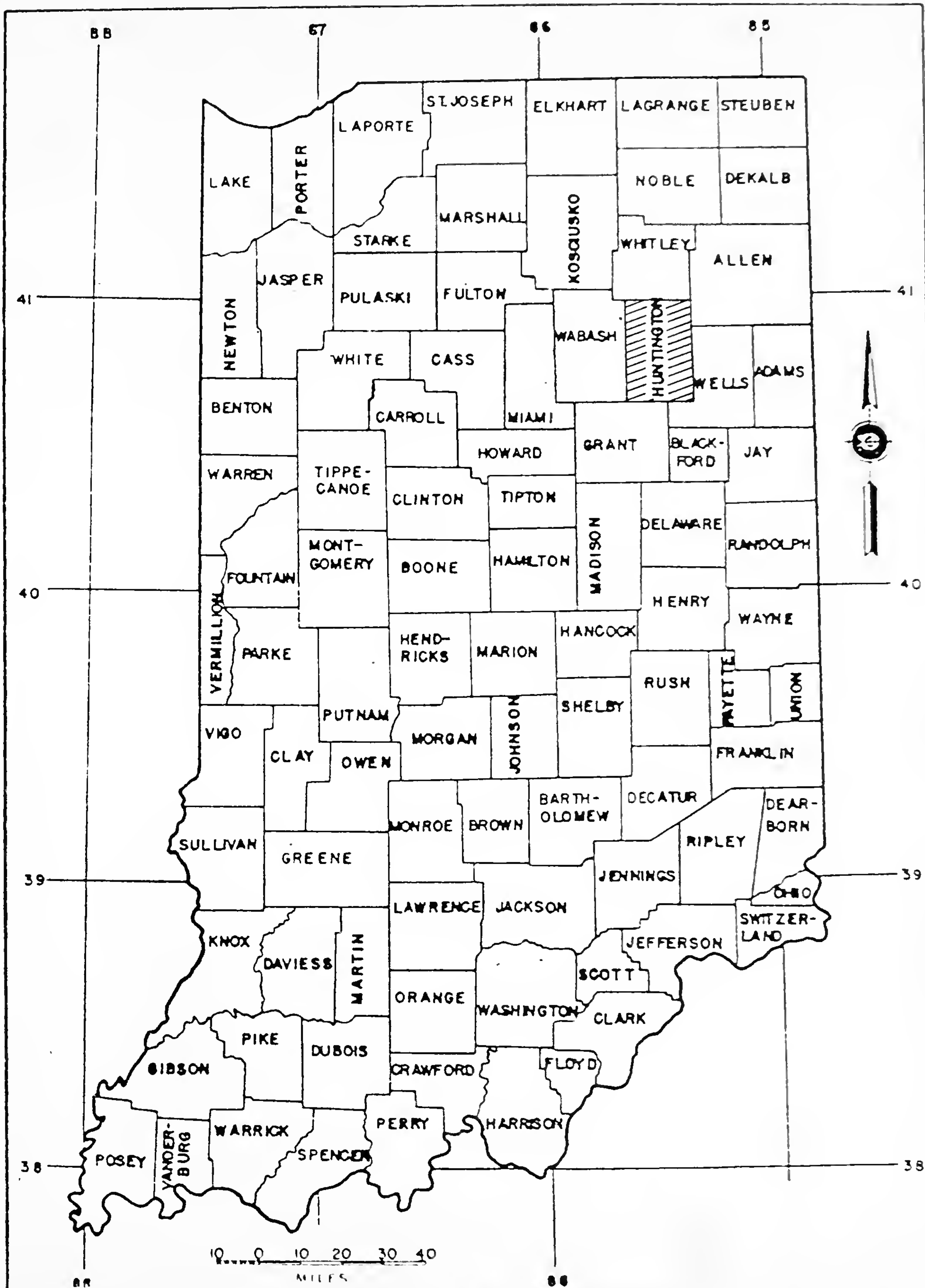


Figure 1 Map of Indiana Showing Location of Huntington County

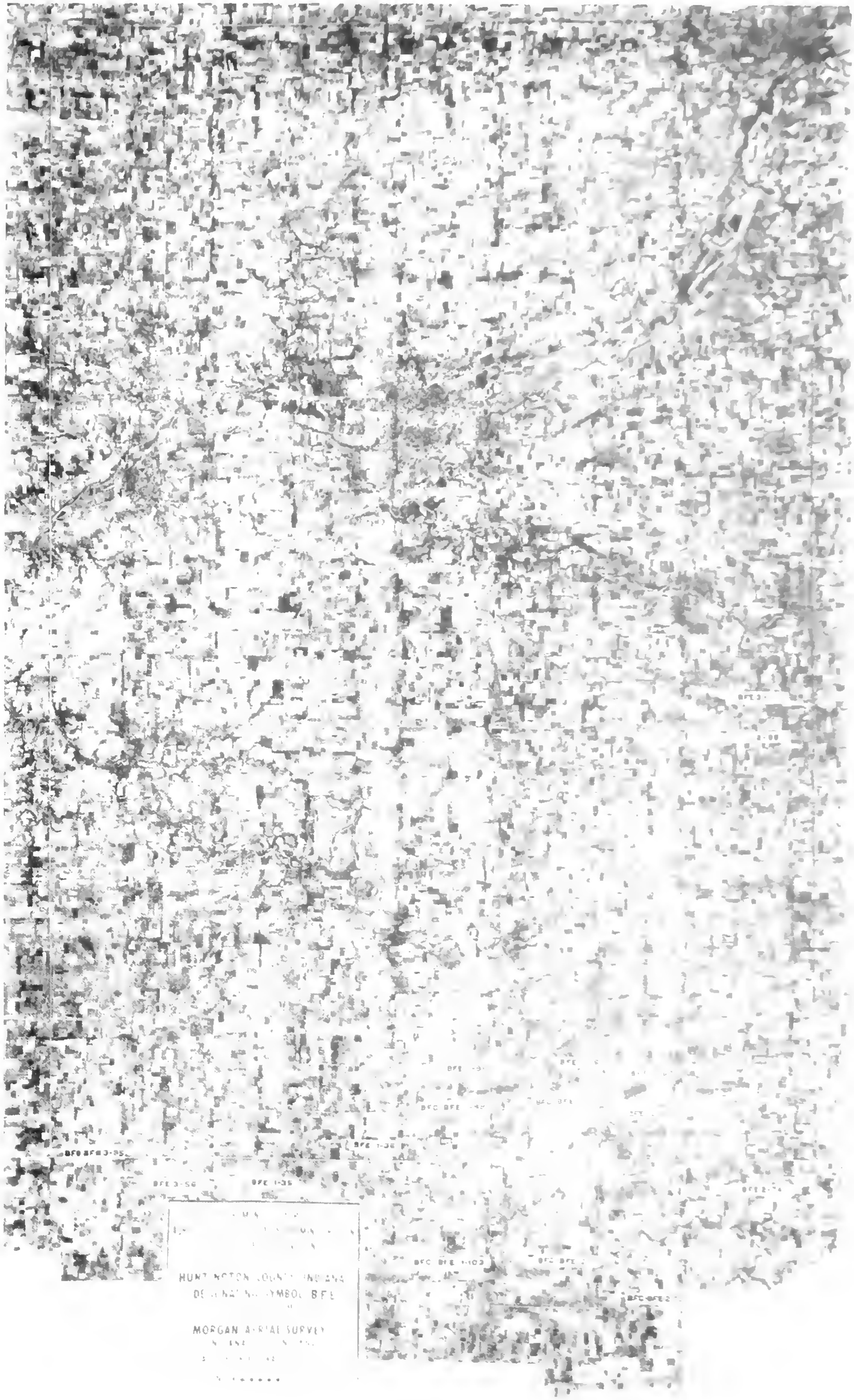


Figure 2. 1938 Photomosaic of Huntington County, Indiana

developed over the various parent materials in Huntington County. The information obtained from the hand-sampling was used with roadway and agricultural soil survey data in the development of general land form - parent material association soil profiles shown on the left-hand side of the engineering soils map.

The Engineering Soils Map of Huntington County, Indiana represents part of a comprehensive, county by county, engineering soil survey of the State of Indiana using a standard set of symbols developed by the Airphoto Interpretation Laboratory, School of Civil Engineering, Purdue University. A primary objective of the mapping project was to develop a survey whereby all soil boundaries and land form - parent material associations correlated across county lines. In the process of airphoto interpretation, some subjective disagreement may occur as to the nature of a given soil unit and the location of its boundaries. Where the interpretations of this author differed from those of authors of adjacent counties, every effort was made to determine the land form pattern percieved by the other author and integrate the given soil unit into the soil boundary pattern of Huntington County. In some instances, soil boundaries were terminated rather abruptly, very near to the Huntington County line. Some of the anomalous areas were controversial due to a lack of adequate relief (ie., less than five feet) on which to base a judgement for boundary placement by stereoscopic inspection. Other disputed areas resulted from differences in mapping detail between Huntington and adjacent counties.

The text of this report supplements the engineering soils map and includes a general description of the study area as well as more detailed information about the various land form - parent material associations found in Huntington County. The map itself shows the land form - parent material areas, surface soil textures and generalized soil profiles. Available roadway soil survey data for the numbered boreholes shown on the map and the engineering properties, characteristics, and suitability of the pedalogical soil series mentioned with regard to the various land form - parent material associations are given in appendices in the back of this report. Information contained in the appendices includes the following:

1. Appendix A-1, Estimated Engineering Properties
2. Appendix A-2, Physical and Chemical Soil Properties
3. Appendix A-3, Soil and Water Features
4. Appendix A-4, Construction Materials
5. Appendix A-5, Building Site Development
6. Appendix A-6, Sanitary Facilities
7. Appendix A-7, Water Management
8. Appendix A-8, Recreational Development

All of the material in Appendix A was taken directly from the SCS Soil Survey of Huntington County (2).

DESCRIPTION OF THE AREA

General

Huntington County is located in the northeast part of the State of Indiana and has an approximate area of 390 square miles, or 249,600 acres (2). Huntington County is bordered to the north by Whitley County, to the east by Allen and Wells Counties, to the south by Wells and Grant Counties and to the west by Wabash County. The City of Huntington, located in the north-central part of the county near the junction of the Wabash and Little Wabash Rivers, approximately 85 miles northeast of Indianapolis, is the seat of county government.

Huntington County had a total population of 35,596 in 1980 of which 20,687 lived in cities and towns, while 14,909 lived in rural areas (3). Table 1 lists the population of the major cities and towns in Huntington County.

Table 1. 1980 Population of Cities and Towns in Huntington County, Indiana (3).

City/Town	Population
Andrews	1,243
Huntington	16,202
Markle + (Wells Co.)	975
Mt. Etna	122
Roanoke	891
Warren	1,254

Population increased by less than 1,000 over the 1970 figure for

Huntington County.

Huntington County is served by State, Federal, and Interstate highways. Interstate 69 cuts across the southeast part of the county, turning northward near Markle before crossing the Wells County line east of the City of Huntington. U.S. Highway 24 extends northeastward to Fort Wayne and westward to Wabash from the City of Huntington. U.S. 224 extends southeast from the city into Wells County. State highways include S.R. 3, 9, 105 and 221 in the north-south direction and S.R. 16, 24, 114 and 218 in the east-west direction. S.R. 37 extends diagonally across the county (via S.R. 9 and U.S. 24) from the southwest to the northeast corner of the county while S.R. 5 passes through the City of Huntington in a northwest-southeast direction.

Railroads provide freight service from the City of Huntington to Chicago and Fort Wayne and to neighboring Wabash and Wells counties and points beyond (2). The city has no rail passenger transportation. The Huntington County municipal airport is located about two miles southeast of the city and provides for limited commuter and private flights.

Approximately 159,059 acres were in cropland in Huntington County in 1974, down 6.3 percent from 1969 (2). Urban land continued to increase at the expense of cropland, particularly around the city of Huntington and toward the northeast part of the county along the U.S. 24 corridor to Fort Wayne. Roughly seven percent of the county was in woodland in 1974.

Ground water provides the primary source of potable water in Huntington County (2). Drinking water is supplied by eight deep wells for the City of Huntington and is supplemented by water from the Wabash River for some industrial and municipal purposes. The flood control Huntington Reservoir, located on the Wabash River about three miles southeast of the county seat, and the Salamonie Reservoir, which crosses the Wabash County line in the Salamonie River Valley, serves as recreational areas for the county populace.

Climate

Huntington County is located in a region of temperate climate in the North American mid-continent. The area experiences invigorating weather with occasional extreme fluctuations in temperature on a daily basis and a wide range of temperatures seasonally. Weather fronts, associated with passing pressure systems, bring rapid temperature changes and the potential for severe weather including high winds, heavy snowfall, thunderstorms, hail, and heavy rainfall, depending on the time of year. Atmospheric changes are most dramatic during the spring and least so during late summer and early fall.

Temperature extremes included a record high of 110^{o} F in July, 1936 and a record low of -20^{o} F in January, 1936* (4). The highest mean daily maximum temperature of 86.8^{o} F occurred in July, the hottest month of the year, while the lowest mean daily

* Note: records refer to the period 1934-1963.

minimum of 18.2^{o} F occurred during the month of January. January had a monthly mean temperature of 26.3^{o} F and July experienced a monthly mean temperature of 74.2^{o} F. The thermometer registered 90^{o} F or higher an average of 27 days and remained below freezing about 38 days per year. The temperature dropped below 0^{o} F about seven times per year.

Precipitation is distributed fairly evenly throughout the year, with the spring and early summer receiving somewhat more than the rest of the year. A high monthly mean of 4.21 inches fell in June while a monthly minimum of 2.06 inches fell in December. A record 5.07 inches of rain fell on a June day in 1959. An average of 25 inches of snow fell per year, most of it coming during the period December through March (5). Total yearly precipitation amounts to about 22 inches.

Severe weather, commonly associated with frontal systems, includes thunderstorms which occur primarily between the months of April and October, and a rare tornado which is most likely to occur in the spring of the year when the atmosphere is most active.

Climatic data for Huntington County is summarized in Table 2.

LATITUDE 40° 53' N.
LONGITUDE 85° 30' W.
ELEV. (GROUND) 802 Ft.

Table 2. Climatological Summary (4)

STATION HUNTINGTON, INDIANA

MEANS AND EXTREMES FOR PERIOD 1934-1963

Month	Temperature (°F) Means: Daily maximum	Means: Daily minimum	Means: Monthly	Extremes: Record highest	Year	Record lowest	Year	Mean degree days **	Precipitation Totals (Inches): Mean	Greatest daily	Year	Snow, Sleet: Mean	Maximum monthly	Year	Greatest daily	Year	Mean number of days: Precip. .10 inch or more	Temperatures Max.: 90° and above	Max.: 32° and below	Min.: 32° and below	Min.: 0° and below	Month
(a)	30	30		30		30		30	30	30		30	30		30		10	30	30	30	30	
Jan.	34.4	18.2	26.3	65	1952	-20	1936	1150	2.64	2.16	1950	6.5	18.0	1939	6.0	1950	5	0	13	29	3	Jan.
Feb.	37.5	20.2	28.9	70	1954	-18	1951	997	2.29	2.52	1936	7.3	15.3	1960	8.0	1952	5	0	9	26	2	Feb.
Mar.	47.9	28.2	38.1	84	1938	-8	1948	853	3.36	2.20	1945	3.9	11.0	1947	5.0	1955	8	0	3	22	*	Mar.
Apr.	61.2	38.3	49.8	89	1942	14	1940	456	3.67	1.85	1944	1.6	15.2	1961	6.9	1961	7	0	*	9	0	Apr.
May	72.9	48.3	60.6	95	1934	24	1947	195	4.06	2.81	1946	T	T	1960+	T	1960+	8	1	0	1	0	May
June	82.7	57.9	70.3	106	1934	35	1945	39	4.21	5.07	1959	0	0		0		8	6	0	0	0	June
July	86.8	61.6	74.2	110	1936	42	1941	0	3.57	3.65	1942	0	0		0		8	9	0	0	0	July
Aug.	85.5	60.2	72.9	105	1934	35	1946	0	2.96	3.15	1943	0	0		0		5	7	0	0	0	Aug.
Sept.	78.6	52.2	65.4	103	1953+	26	1951	90	2.66	2.47	1950	0	0		0		6	4	0	1	0	Sept.
Oct.	67.4	42.3	54.9	91	1953+	16	1952	338	2.87	2.93	1955	T	0.6	1962	0.6	1962	5	*	0	5	0	Oct.
Nov.	49.7	31.7	40.7	81	1950	-5	1950	732	2.67	2.99	1936	2.8	12.5	1950	7.0	1950	6	0	2	17	*	Nov.
Dec.	36.8	21.4	29.1	68	1951	-15	1951	1082	2.06	1.64	1936	6.4	16.0	1950	5.1	1960	5	0	11	26	2	Dec.
Year	61.8	40.0	50.9	110	July 1936	-20	Jan. 1936	5932	37.02	5.07	June 1959	28.5	18.0	Jan. 1939	8.0	Feb. 1952	76	27	38	135	7	Year

(a) Average length of record, years.

T Trace, an amount too small to measure.

** Base 65°F

+ Also on earlier dates, months, or years.

* Less than one half.

CLIMATE OF HUNTINGTON, INDIANA

Huntington, located in Huntington County in Northeast Indiana, has an invigorating climate because of the frequent changes of the weather. Pleasant, cloudless days are interspersed with some rainy days throughout the year. Monsoon rains are unknown but rainfall is usually adequate in all seasons favoring a diversified agriculture. In the summer when moisture utilization is high, a dry month of below normal rainfall affects lawns, pastures, and crops.

Weather changes every few days come from the passing of weather fronts and associated centers of low and high air pressure. In general, a high brings lower temperatures, lower humidity and sunny days. An approaching low brings increasing temperatures, increasing southerly wind, higher humidity, and commencement of rain or showers. This activity is greatest in the spring and least in late summer and early fall.

Precipitation is rather evenly distributed throughout the year, a happy contrast to some areas of the United States that have a "dry season" and require irrigation to maintain green vegetation. The table of monthly rainfall for past years in this report shows the variation of rainfall that may be expected. There is a tendency for spring and early summer rains to exceed winter precipitation. The spring rains are very reliable insuring near maximum soil moisture going into summer when evaporation losses exceed rainfall and dry soils become more probable. A severe drought has never been experienced. About one-third of the annual rainfall flows into streams and out of the area. Future needs may require conservation of this water.

The probability for unusually heavy rains in just a few hours is indicated by a weather study of the area:

Frequency in 100 years	Rain in 1 hour	6 hours	12 hours
4	2.1	3.2	3.7
10	1.7	2.8	3.2
20	1.5	2.4	2.8

Snowfall has varied reception. None occurs in the summer. Some winters have much snow and others have very little. An occasional snow storm may hamper travel and clog roads but at the same time the snow blanket protects winter grains from the very cold air that invariably follows. Heaviest snow storms are those out of the southwest. As they swirl northeastward, abundant moisture flows in from the Gulf of Mexico. A storm out of the northwest, with an inward flow of colder, drier air, leaves less snow. Some mid-winters are thus cold but snowfall is normal or less.

Relative humidity is not measured at this station but estimates are possible from the climatology of the area. Relative humidity varies on sunny summer days from a percent in the 40's in the early afternoon to the 90's about sunrise. Relative humidity rises and falls much as temperature does during a typical day but the highest percent usually occurs with the minimum temperature and the lowest percent with the maximum temperature. A cold front is next in importance in changing relative humidity downward.

Winds blow most frequently from the southwest, however, in one or two of the winter months, prevailing winds are northwest. Damaging winds have three sources. In the order of diminishing area coverage but increasing intensity, they are: lows passing through the region, thunderstorms, and tornadoes. Only 10 tornadoes have been reported in the County since 1916. Very few were of sufficient size to injure people and property. Thunderstorms, including incidences of lightning and thunder, occur about 46 days of the year. Most of these occur in the spring and early summer. They are seldom so severe as to cause loss of life, property, or crops. Death dealing smog or fog is unknown.

Heating degree days in the above table provide a comparative number for calculating heating requirements between different places and different times. Fuel consumption for heating is proportional to degree day totals, so a month with twice the heating degree days of another month requires twice as much fuel for heating. Degree days for a single day are obtained by subtracting the mean temperature from 65 degrees.

The growing season (defined here as the number of days between the last spring and first fall temperature of 32°) averages 155 days in length. The season is 176 days or more in 10% of the years, 166 days or more in 25% of the years, less than 144 days in 25% of the years, and less than 134 days in 10% of the years.

Many days of the year are nearly ideal in temperature. A few days, in the summer when temperatures exceed 90, or decline below zero in the winter, tend to obscure this fact. The fall season is considered by many as the best time of year for outdoor activities. Spring is also a favorite season but actually this season has more days of rain and thunderstorms. In the fall the atmosphere in total seems more quiet. Air and soil temperatures are nearer in agreement than any other time of the year, thus, convective activity is diminished. Many days are sunny and showers are less frequent.

Lawrence A. Schaal
Weather Bureau State Climatologist
Purdue University, Agronomy Department
Lafayette, Indiana

Table 2., Continued

Average Temperature (°F)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann'l
1934	32.4	20.4	33.4	48.8	64.9	76.8	80.0	72.2	65.2	54.0	44.4	26.2	51.6
1935	27.8	29.4	43.8	46.1	54.2	66.6	76.7	73.0	64.0	51.6	39.8	24.1	49.8
1936	20.4	18.9	41.4	45.9	63.8	69.0	79.5	76.7	68.0	53.2	37.0	33.5	50.6
1937	30.1	28.7	33.8	48.6	60.1	68.6	73.5	74.7	63.0	50.2	32.2	26.3	49.6
1938	27.0	35.6	44.9	51.2	60.7	68.4	73.8	74.4	65.4	56.0	43.4	30.6	52.6
1939	31.2	29.1	39.2	45.6	63.6	72.7	73.8	72.0	69.9	54.4	39.5	33.2	52.0
1940	14.4	29.0	32.8	45.7	56.9	71.0	74.0	73.6	63.3	56.3	32.8	35.0	49.2
1941	22.2	25.7	32.8	54.5	62.6	70.0	75.8	72.6	69.8	56.0	42.2	35.6	52.1
1942	26.4	24.4	39.6	54.1	61.2	70.2	73.9	70.6	62.5	54.2	42.8	25.4	50.4
1943	26.1	30.6	35.6	46.5	60.0	74.6	74.4	72.3	61.0	52.0	38.0	27.4	49.9
1944	31.2	31.4	34.6	47.0	66.2	74.4	74.9	74.8	66.3	52.6	42.0	24.1	51.6
1945	20.0	30.1	49.8	52.2	54.9	67.5	72.0	71.2	66.8	51.6	42.4	23.8	50.2
1946	28.6	31.2	49.2	51.0	58.2	68.9	73.8	68.8	66.4	58.6	45.0	34.2	52.8
1947	30.3	21.5	31.8	48.6	57.0	67.0	70.0	79.2	66.0	60.5	36.4	29.6	49.8
1948	19.4	28.1	38.7	53.8	59.5	69.5	73.8	71.9	67.5	50.2	45.2	31.6	50.8
1949	31.9	32.7	39.8	48.4	62.6	72.9	76.6	73.2	59.4	58.0	-	-	-
1950	-	-	33.8	43.9	62.3	68.5	70.6	69.9	63.4	58.2	35.5	21.7	-
1951	28.8	28.6	37.3	42.7	61.6	68.4	72.5	70.6	62.6	56.4	34.2	28.9	49.8
1952	30.9	33.2	36.9	50.6	58.2	74.5	76.3	71.5	63.7	48.2	41.8	33.1	51.6
1953	31.3	33.9	40.2	45.9	62.8	73.6	75.0	73.7	65.8	57.1	43.4	32.3	52.9
1954	29.0	37.0	35.6	55.4	56.4	73.3	75.0	72.0	68.0	54.6	41.3	41.3	52.4
1955	26.8	30.3	39.7	57.3	62.8	67.4	78.7	76.2	68.1	55.3	38.2	27.6	52.4
1956	26.4	30.4	38.2	48.9	61.2	71.7	73.1	73.2	63.8	59.3	41.9	35.9	52.0
1957	21.5	34.0	38.9	51.0	61.0	70.9	73.9	72.0	64.2	50.5	41.1	35.6	51.2
1958	27.3	22.8	36.1	51.2	60.1	65.2	73.1	71.5	64.6	54.7	43.4	22.3	49.4
1959	22.7	29.4	37.8	51.4	65.3	71.1	73.3	72.5	68.6	53.7	36.5	36.1	51.9
1960	29.3	29.6	25.9	53.9	58.5	67.6	71.2	73.0	68.3	54.2	43.5	25.6	49.9
1961	23.6	34.1	42.4	45.3	56.6	68.0	72.5	71.6	69.6	55.8	41.5	27.2	50.7
1962	22.3	27.3	35.9	49.8	66.9	70.4	71.4	72.5	63.0	56.5	40.7	24.5	50.1
1963	12.5	21.2	41.6	51.5	58.5	70.4	73.0	68.7	64.3	61.4	45.6	19.7	49.4
1964	30.3	28.0	37.8	51.6	64.8								

Total Precipitation (Inches)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann'l
1934	0.41	1.18	3.03	0.93	0.89	1.94	1.97	4.83	4.14	0.93	2.78	1.63	25.21
1935	3.38	1.32	4.84	3.20	5.41	4.68	2.41	2.79	2.05	1.41	3.32	1.69	36.50
1936	1.55	4.92	2.72	1.89	1.79	2.97	1.99	4.16	4.87	3.04	2.99	3.24	36.13
1937	6.28	1.79	2.10	5.91	4.17	5.91	3.66	3.30	2.43	3.10	1.58	2.22	42.45
1938	0.46	2.67	5.62	3.13	5.38	5.75	4.63	4.62	2.92	0.78	1.69	2.13	39.83
1939	3.71	3.46	3.24	5.24	0.93	2.48	3.66	2.88	0.43	4.12	1.37	1.23	32.75
1940	2.35	1.55	2.88	4.83	4.52	3.15	2.28	1.77	0.42	4.65	3.12	2.29	33.81
1941	1.90	0.10	0.92	2.78	2.94	5.45	2.14	1.68	1.97	0.07	2.98	1.98	30.96
1942	1.82	3.61	3.73	3.59	2.73	3.11	6.24	2.49	3.14	2.03	4.31	1.89	38.69
1943	1.83	1.18	2.58	2.99	9.60	1.59	4.10	5.06	3.42	0.67	2.61	0.57	36.20
1944	0.69	2.29	3.81	2.91	6.95	0.44	1.26	1.86	1.53	2.72	4.47	1.89	35.87
1945	0.21	1.89	6.81	3.20	4.95	4.41	5.35	4.33	3.54	3.81	1.83	2.27	43.10
1946	1.35	1.80	2.29	0.92	6.02	3.74	2.02	0.93	1.53	3.24	2.18	2.20	28.72
1947	3.50	0.49	2.50	5.43	4.47	3.94	2.65	3.20	4.48	2.63	2.12	1.85	37.26
1948	3.49	2.82	5.45	2.24	4.76	5.15	3.21	1.57	4.52	2.18	4.06	3.82	43.27
1949	8.09	2.94	2.27	1.92	5.12	7.02	3.69	2.17	3.52	6.07	1.25	4.15	48.21
1950	9.40	4.32	2.68	5.75	2.21	4.42	2.95	4.18	4.11	1.68	4.51	2.10	48.36
1951	1.60	3.24	3.63	3.43	3.76	6.79	3.20	2.77	1.58	3.64	3.22	3.98	41.34
1952	4.10	2.56	5.16	3.79	6.47	3.47	2.21	4.63	3.83	0.53	2.22	2.01	41.48
1953	2.42	1.57	5.02	3.33	3.18	2.22	4.18	1.68	1.67	1.32	1.79	1.36	29.84
1954	2.28	2.59	1.76	3.07	2.91	3.93	5.00	6.75	2.05	8.55	1.79	2.19	42.87
1955	1.54	1.32	5.44	2.47	1.98	2.60	6.24	3.36	1.96	6.66	4.43	0.59	38.59
1956	1.26	4.00	3.32	1.69	5.95	4.14	3.02	2.37	1.13	0.62	2.71	2.79	33.00
1957	1.87	1.17	1.28	8.21	4.05	7.52	3.91	2.50	2.73	4.04	1.92	4.74	43.94
1958	1.25	1.16	0.93	1.80	2.36	9.43	6.23	3.48	3.67	0.83	4.31	0.45	35.90
1959	4.00	3.67	2.96	2.96	4.85	6.94	2.01	1.72	4.43	3.78	2.82	2.39	42.53
1960	2.32	3.00	1.42	1.96	4.54	4.00	2.92	3.16	2.78	1.71	1.32	1.16	30.39
1961	0.44	2.40	4.19	5.50	2.11	4.64	4.93	2.22	3.39	2.50	2.64	1.62	36.63
1962	3.46	2.49	2.69	1.33	4.09	1.89	4.22	1.68	1.29	2.57	1.15	0.50	27.36
1963	0.97	1.23	5.02	3.84	2.94	2.82	4.42	1.40	0.43	0.28	2.21	0.95	26.51
1964	2.50	1.44	4.82	6.06									

STATION HISTORY

This study of local climate is possible because a citizen of the community for many years generously donated a few minutes a day, seven days a week, reading and recording weather information from government instruments. The present observer is George P. Dolby. His weather station has been located 1.1 miles northeast of the post office in Huntington, Indiana, since June 1, 1954. Earlier observers, dates of service, and location of station are: William McGrew, November 1, 1893 to January 31, 1906; Charles McGrew, February 1, 1906 to May 31, 1915, 153 N. Jefferson Street; C. Horace Kiracofe, June 1, 1915 to August 31, 1924, 349 W. Tipton Street; Ivan O. Murphy, January 1, 1925 to August 12, 1928, 803 Olinger Street; Carl F. Ogle, August 24, 1928 to November 30, 1928, 1836 College Avenue; and Fred C. Maloney, March 1, 1929 to May 31, 1954, 231 Vine Street.

EXTREMES AND DATES OF OCCURRENCE (1893-1963)

Month	Highest Temperature		Lowest Temperature		Greatest Daily Precipitation		Greatest Monthly Snowfall	
Jan.	66	1/27/16	-20	1/23/36	2.16	1/3/50	21.9	1895
Feb.	70	2/15/54	-18	2/2/51	2.52	2/26/36	24.5	1900
Mar.	84	3/22/38	-8	3/12/48	2.88	3/14/25	28.0	1899
Apr.	91	4/26/15	14	4/12/40	1.85	4/11/44	15.2	1961
May	97	5/31/19	24	5/9/47	3.52	5/7/96	3.5	1923
June	106	6/1/34	35	6/5/45	6.06	6/22/00		
July	110	7/14/36	42	7/20/41	3.65	7/31/42		
Aug.	105	8/9/14	35	8/30/46	3.93	8/3/29		
Sept.	103	9/2/53	26	9/29/51	3.63	9/3/32	T	1917
Oct.	94	10/7/27	15	10/27/26	3.22	10/12/01	3.5	1950
Nov.	81	11/1/50	-5	11/25/50	1.93	11/7/25	12.5	1950
Dec.	68	12/3/51	-15	12/16/51	1.94	12/21/18	17.0	1903

PROBABILITY OF LOW TEMPERATURES IN SPRING AND FALL

Minimum Temp.	Percent of occurrence after the date in spring					Percent of occurrence before the date in fall				
	90%	75%	50%	25%	10%	10%	25%	50%	75%	90%
40	5/18	5/25	6/2	6/10	6/17	9/2	9/9	9/17	9/25	10/2
36	5/4	5/10	5/17	5/24	5/30	9/15	9/21	9/27	10/3	10/9
32	4/22	4/29	5/6	5/13	5/20	9/22	9/30	10/8	10/16	10/24
28	4/6	4/13	4/22	5/1	5/8	10/5	10/17	10/21	10/29	11/6
24	3/18	3/28	4/7	4/17	4/27	10/20	10/27	11/4	11/12	11/19
20	3/6	3/15	3/24	4/2	4/11	10/27	11/4	11/12	11/20	11/28
16	2/24	3/3	3/12	3/21	3/28	11/9	11/18	11/28	12/8	[illegible]

This table summarizes for a 30-year period the dates when low temperatures such as 32°F. last occurred in the spring and first occurred in the fall. The average date is given in the 50% column. The table shows that the last temperature of 32° or lower in the spring occurs after May 13 in 25% of the years, and before September 30 in the fall. Probabilities for other temperatures are indicated. Reference: "Risks of Freezing Temperatures--Spring and Fall in Indiana," by L. A. Schaal, J. E. Newman, and F. H. Emerson.

Physiography

Huntington County is located entirely within the Tipton Till Plain physiographic region of the State of Indiana (6). With respect to North American physiography, it lies in the Till Plains section of the Central Lowlands Province. A physiographic map of Indiana is shown in Figure 3.

Topography

The topography of Huntington County is generally nearly level to strongly sloping north of the Little Wabash River and nearly level to moderately sloping in the southern part of the county. The nearly level terrain of the till plain is broken by the Wabash River, the Little Wabash River, and the Salamonie River and their tributaries and by two ridge moraines which cross the county. Local relief along the three major river valleys is as much as 90 feet (7), while relief in the morainic areas usually does not exceed 20 to 25 feet locally. Topography of the ridge moraines varies from the more common gently undulating swell and sag type to the rolling relief of knob and basin topography in some places. Elevation reaches a maximum of 912 feet above mean sea level in the northwest corner of the county (2). A minimum elevation of 660 feet is located where the Wabash River exits the county at the Wabash county line.

The most prominent topographic feature of Huntington county is the broad, relatively flat valley of the Little Wabash River,

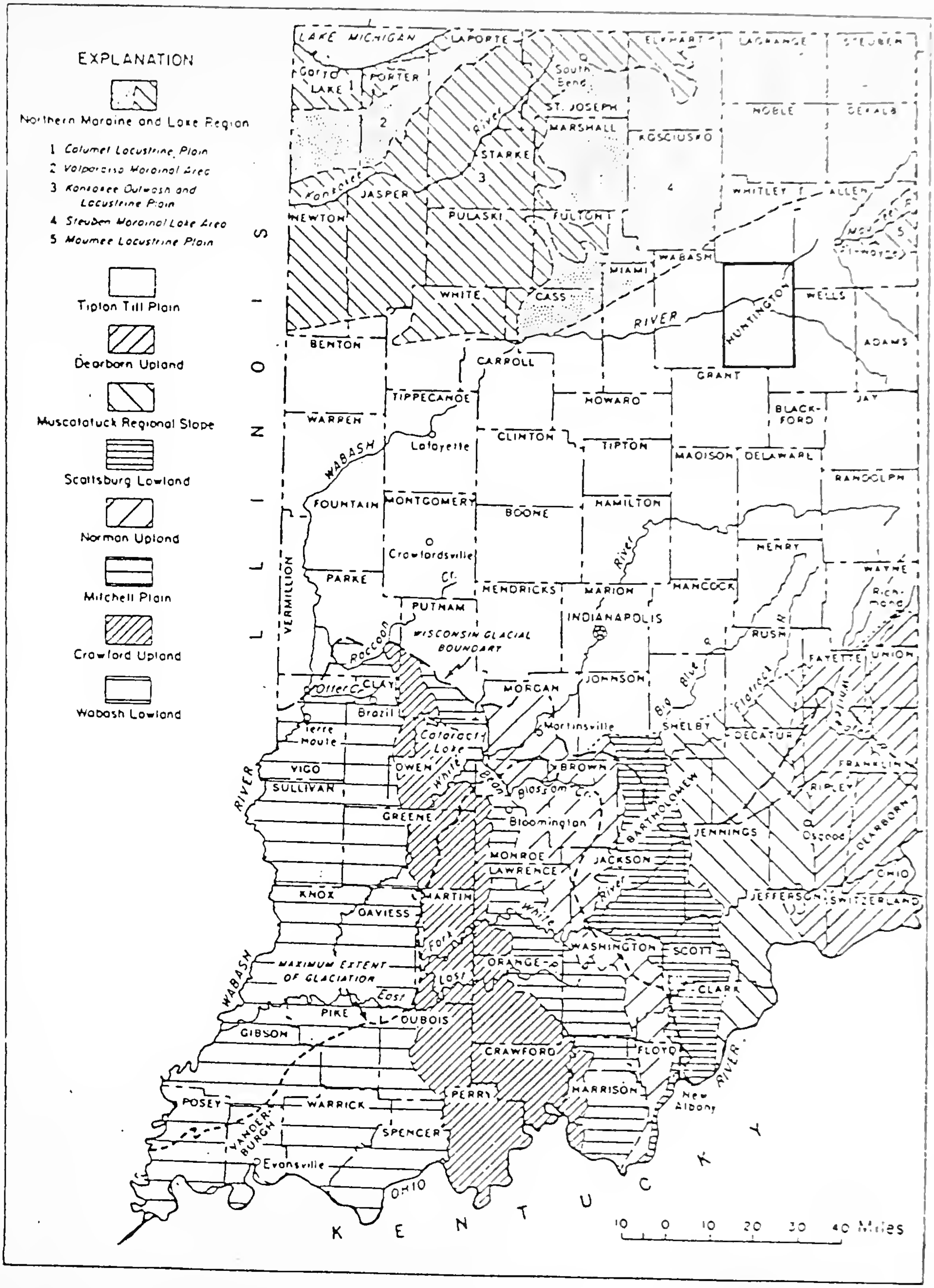


Figure 3. Map Showing Surficial Physiography of Indiana and Location of Huntington County (6)

sometimes referred to as the Maumee Sluiceway, through which large volumes of meltwater once flowed. The present-day Wabash River follows the courses of the sluiceway westward from its juncture with the Little Wabash about 2.5 miles west of the City of Huntington. A topographic map of Huntington County is shown in Figure 4.

Drainage

Huntington County lies entirely in the Wabash River Drainage basin of Indiana (5). The northeast part of the county lies in the Little Wabash River subdivision, while the southwestern part is drained by the Salamonie River Subdivision. A small area in the northwest corner of the county lies in the Eel River subdivision of the Wabash River drainage basin. The remainder of the county drains directly into the Wabash River.

The Little Wabash River is an underfit (narrow relative to width of valley) stream which flows through a wide glacial meltwater channel. Its course was dredged in many places northeast of Mardenis to improve sluggish drainage and was confined by shallow limestone bedrock further on before joining the Wabash River west of the City of Huntington. The Salamonie River is somewhat entrenched and exhibits several large meanders east of Mt. Etna. The Little Wabash and Salamonie Rivers flow through rather deep (up to 90 feet), well established valleys whereas the Wabash River flows through a relatively shallow (less than 50 feet deep), though well defined valley before entering the old

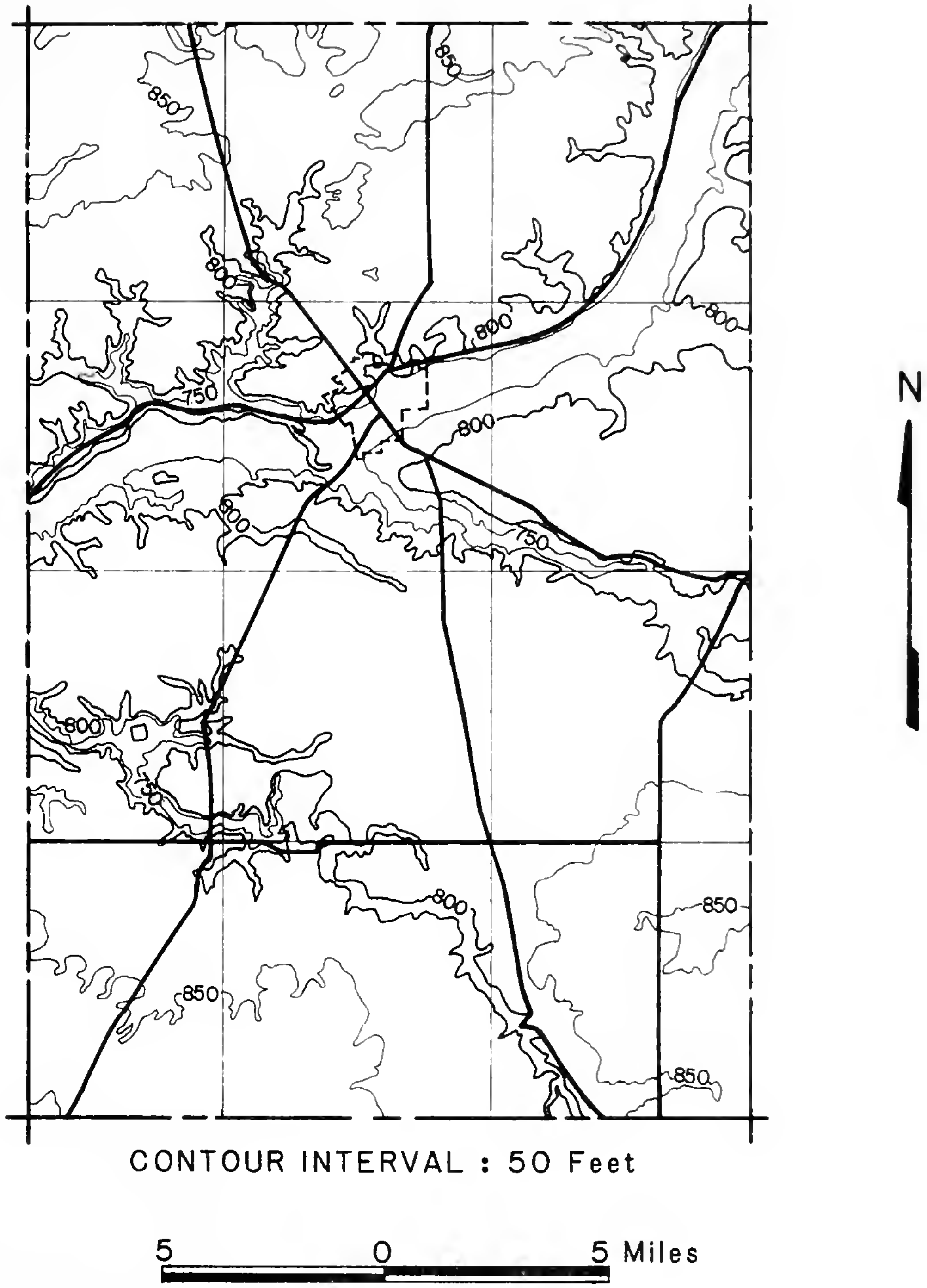


Figure 4. Topographic Map of Huntington County, Indiana (15)

meltwater channel. Shallow limestone bedrock encountered in places by these rivers apparently imposed little control on the stream courses, however, rates of erosion and depositional patterns were definitely modified to some degree.

Numerous local watershed divides are more or less defined by ridge moraines that pass through Huntington County, disrupting a generally dendritic regional pattern of drainage which is shown in Figure 5. The flow of several streams including Loon, Pony, and Clear Creeks appears to be deflected or directed to some extent in places by the ridge moraines. Loon Creek flows nearly parallel to the Wabash River for over ten miles before joining it due in part to a narrow, roughly east-west trending band of ridge moraine. Tributaries of the major streams flowing from areas of ridge moraine in the county are commonly shorter and more numerous than those from other areas due primarily to the more steeply sloping terrain.

The meanders along the Salamonie River are apparently due in part to the presence of a small patch of ridge moraine lodged between the river and Majenica Creek. The ridge moraine apparently impeded the river's flow to the Wabash River and, in effect, backed it up. Tributaries of the Salamonie River as it enters Huntington County are closely spaced and nearly parallel, taking on an almost trellis-like pattern of drainage. Drainage in the ground moraine is generally sluggish and dendritic while that in areas of knob and basin topography within the ridge moraines is often sluggish and somewhat deranged. Streams were

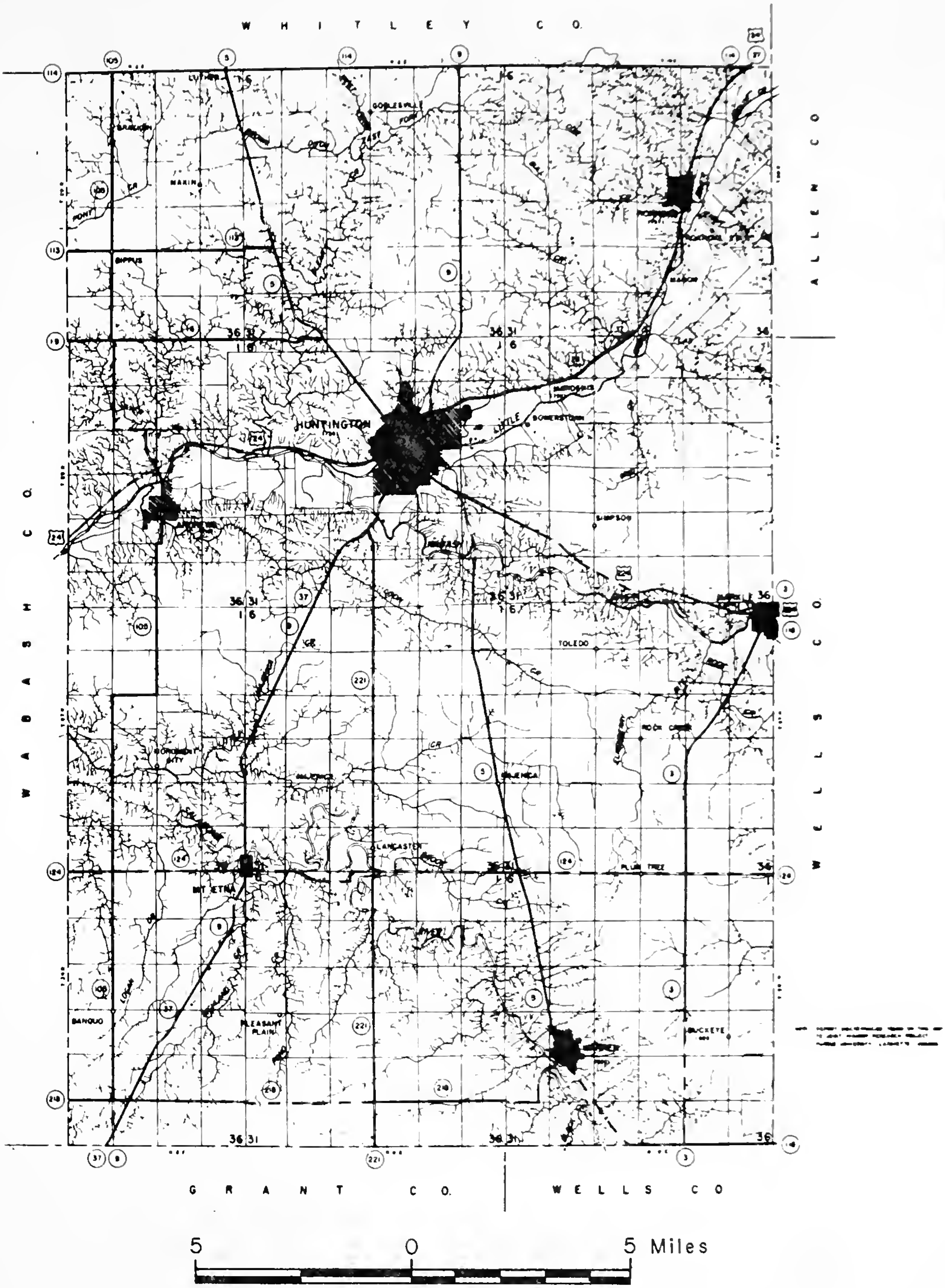


Figure 5. Drainage Map of Huntington County(5)

dredged and trenches excavated in order to improve drainage in these areas and on the broad, flat Maumee River sluiceway valley floor as well.

No natural lakes are found in Huntington County, however, both natural and man-made ponds are numerous (5). As previously stated, two flood control reservoirs are located in Huntington County; the Salamonie Reservoir on the Salamonie River and Huntington Reservoir on the Wabash River.

Glacial Geology

The surficial glacial geology of Huntington County, Indiana consists of till and meltwater deposits of Wisconsinan age. Deposits of Wisconsinan age overlie any materials of Illinoian and Kansan age that may be present as well as those of any earlier glacial episodes. Wisconsinan age deposits include ridge and ground moraine, outwash and sluiceway sands and gravels, shallow or slackwater lacustrine deposits and some small, isolated patches of eolian sands north of the Little Wabash meltwater channel. The only surficial materials not of Wisconsinan age are recent alluvial and organic deposits as well as some shallow or slackwater lacustrine sediments. Silurian age limestone bedrock outcrops along the Wabash, Little Wabash, and Salamonie Rivers, and Rock Creek (8).

The Salamonie moraine (named after the river), passes in a discontinuous, somewhat arc-like fashion from the northwestern to

the southeastern parts of Huntington County while the Mississinewa moraine crosses the northwest and southwest corners of the County (6). Both moraines were formed by the Erie Lobe of the Wisconsinan ice sheet (7). The ridge moraines are generally more rugged and are somewhat coarser in texture then the surrounding, relatively flat and featureless ground moraine. The Salamonie moraine is one of the least well defined ridge moraines formed by the Erie lobe in Indiana, however, relief of 20 to 30 feet is not uncommon near the Whitley county line.

Drift thickness in Huntington county (see Figure 6) ranges from less than one foot where bedrock outcrops along the major river valleys to more than 400 feet in the southwest part of the county along the Grant County line. Unconsolidated materials are generally less than 100 to 150 feet thick and limestone bedrock is less than 10 to 20 feet from the surface in several places based on roadway borehole logs and other information (9). The till is composed primarily of unsorted clay, sand, and silt with lesser amounts of gravel and cobble and boulder-sized rock fragments. Thick lenses of sand and gravel are incorporated in the till and are most common between the deposits of the earlier Tazewell and later Cary sub-ages of the Wisconsinan glacial period. Most of the tills at the surface in Huntington County are deposits of the Cary sub-age, although Tazewell age till is exposed along several bluffs of tributary streams to the Salamonie River near the Wabash County line (10). The thickest drift, located along the southern county line, is associated with

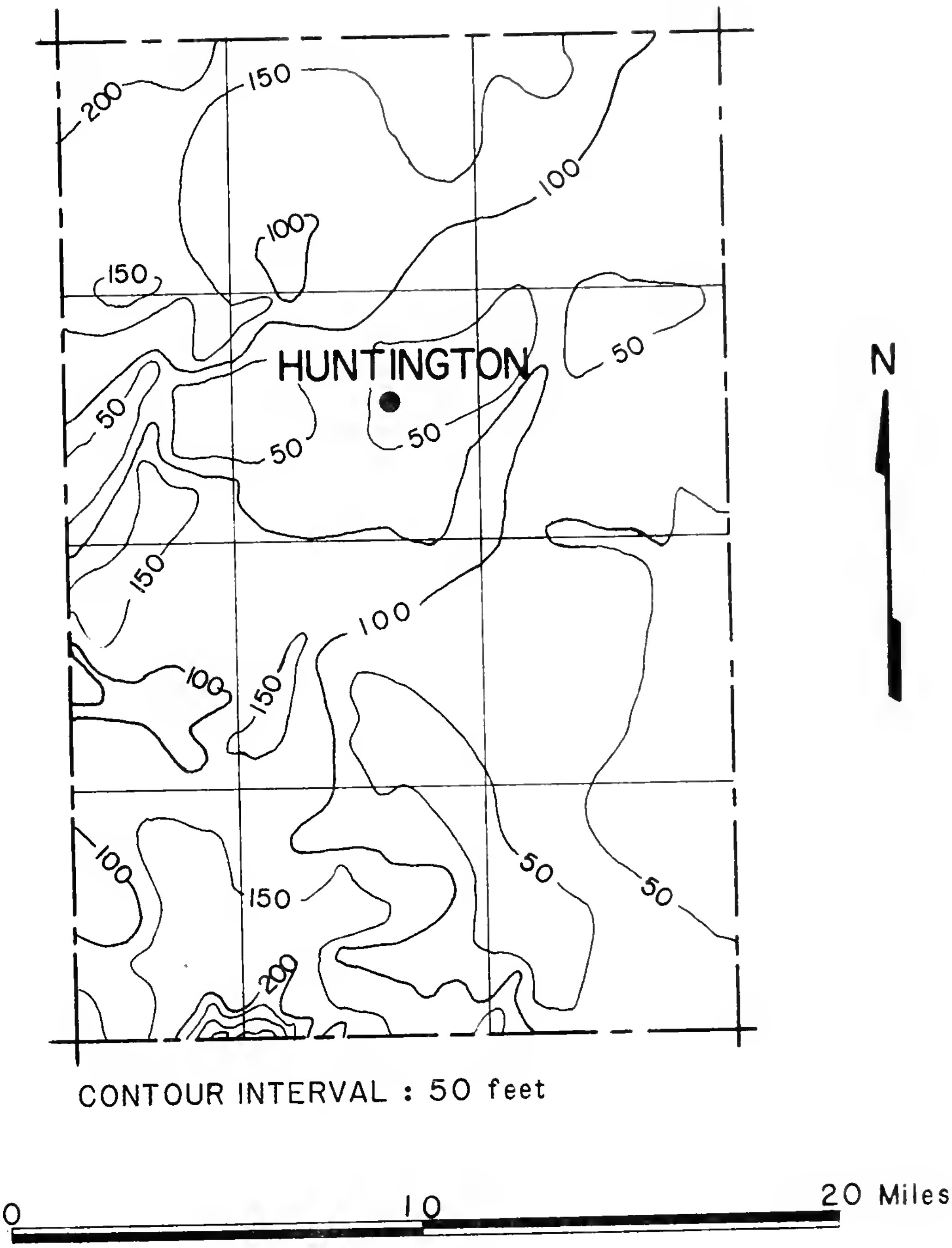


Figure 6. Unconsolidated Materials Thickness Map of Huntington County, Indiana (9)

a tributary of the preglacial Teays bedrock river valley (5).

The most distinctive glacial feature in the county is the previously mentioned meltwater channel associated with the present course of the Little Wabash River and the Wabash River. The channel sweeps in an arc from the northeast corner of the county southwestward, passing through the City of Huntington and exits the county about half way up the western county line where the Wabash River follows it to the Ohio River. Sometimes referred to as the Wabash or Maumee Sluiceway (10), the channel is up to two and one-half miles wide, in some places, and local relief along the channel wall of as much as 80 to 90 feet is not uncommon (5). The valley of the Wabash River upstream from its juncture with the Little Wabash River is thought to have been eroded primarily by the Wabash River itself and is, in contrast, rarely more than one half of a mile in width and local relief is not more than 50 feet along the valley wall.

The geologic history of the Wabash meltwater channel is rather complex and unique. The valley contains three well defined levels: an upper or Mississinewa terrace; a lower terrace called the Maumee terrace, and the lowest level which is the flood plain of recent age (10). The upper Mississinewa terrace was formed by sand and gravel-bearing meltwater during the late Tazewell and early Cary Wisconsinan glacial sub-ages. The lower Maumee terrace was carved out of the earlier Mississinewa outwash materials by the flood waters that escaped from glacial lake Maumee when it topped the ridge moraine dam that contributed to its

formation near the City of Fort Wayne. The lowest or flood plain level was eroded in recent time by the post-glacial Wabash and Little Wabash Rivers. The two terrace levels were distinct all the way to the mouth of the Wabash River (11).

The meltwaters of the Maumee or Wabash sluiceway eroded the overlying drift and cut a channel into the underlying Silurian age limestone/dolomite bedrock as much as 15 to 20 feet in some places (12). The same sort of situation occurred along the much smaller Salamonie sluiceway, only to a much less extent. The flood and meltwaters of the so-called Wabash sluiceway apparently scoured the valley floor to a somewhat deeper depth from the northeast corner of the county to about three miles east of Huntington near Mardenis where rapid erosion was impeded by limestone/dolomite bedrock. When the flood and meltwaters abated, water apparently backed up behind the slightly higher bedrock valley floor forming a shallow or slackwater lake in which lacustrine silts and clays were deposited over any underlying glacio-fluvial sands and gravels. This interpretation is strictly the author's and is based on information obtained from the SCS Soil Survey of Huntington County (2) and roadway borehole information as well as information obtained from other sources of literature during previous studies.

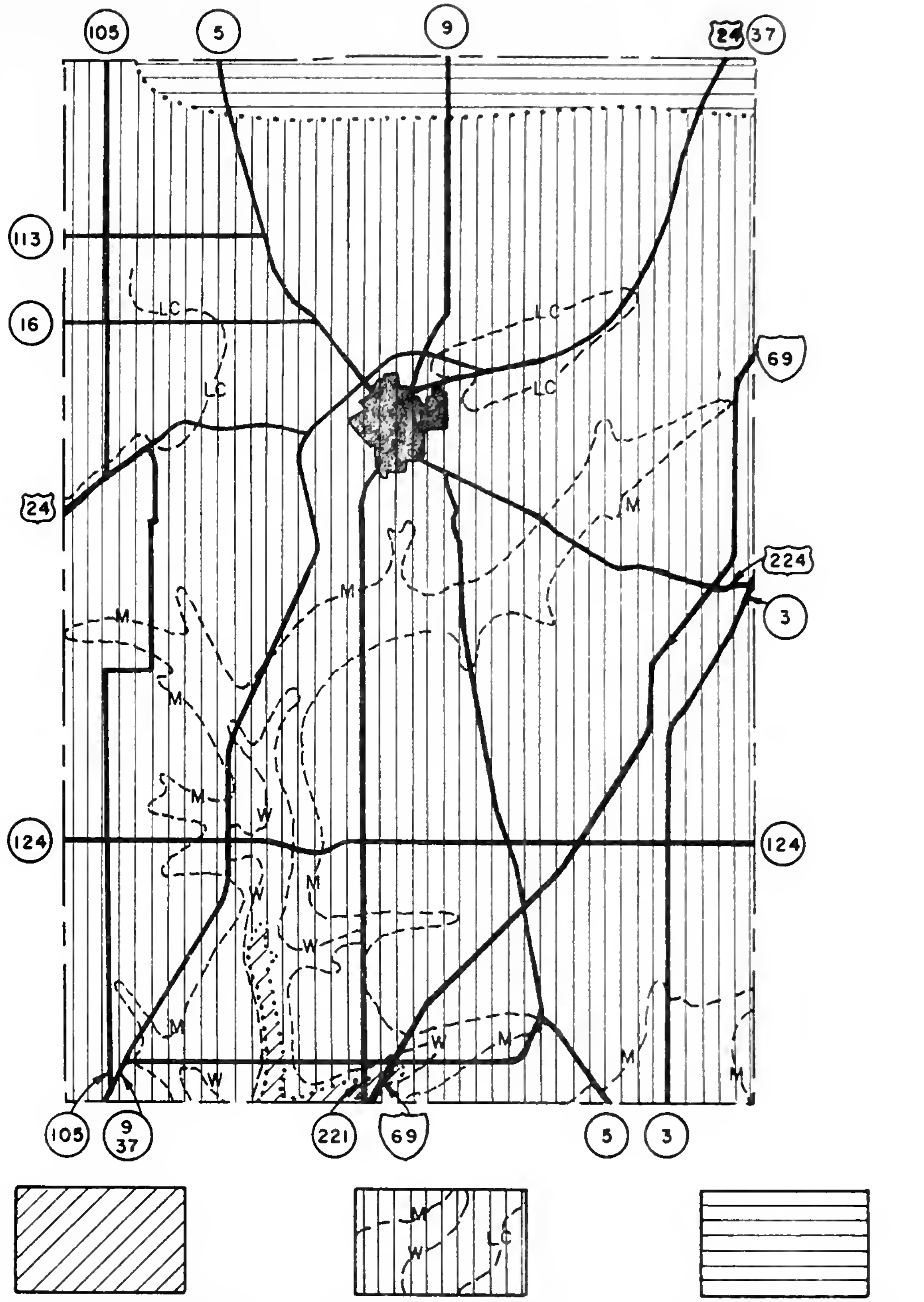
Bedrock Geology

Huntington County, Indiana is underlain primarily by shale, limestone, and dolomite bedrock of Silurian age (7). Ordovician

age limestone and shale is found at the bedrock surface in a deep, preglacial Teays River tributary valley in the southwest part of the county (see Figure 7). Sandstone and limestone of Devonian age lies beneath the northern county line.

Huntington County is located in the Bluffton Plain bedrock physiographic unit of Indiana as shown in Figure 8 (13). The Bluffton Plain exhibits topography typical of a well dissected peneplain (see Figure 9) with intervalley bedrock surface elevation of about 700 to 800 feet above mean sea level. Beds dip regionally less than five degrees to the north away from the Cincinnati Arch (7). Bedrock structure, as defined by the surface of the Trenton Formation, is shown in Figure 10.

Limestone and dolomite are exposed at the surface in numerous places in the Wabash River and Little Wabash River valleys, and in some places along the valleys of the Salamonie River and Rock Creek (7) (12). A limestone bench is found near the surface about one mile southeast of the town of Warren in Huntington County along the Salamonie river. The bench bears the symbol of thin outwash, recent alluvium, and residual soil over shallow limestone-dolomite bedrock on the engineering soils map which accompanies this report. Limestone is exposed along the Wabash River near the town of Markle where a quarry is located on the tributary Rock Creek about one mile south of the town. Limestone first appears along the Little Wabash River near the town of Mardenis and is exposed nearly continuously to a point about three miles west of the junction with the Wabash River where it



LATE ORDOVICIAN AGE
Shale and limestone

EARLY AND MIDDLE SILURIAN AGE
Limestone, dolomite, and shale
M — base of Mississinew Shale Member
W — base of Waldron Formation
LC — base of Liston Creek Limestone Member

DEVONIAN AGE
Limestone and Sandstone

Figure 7. Geologic Map of Huntington County (16)

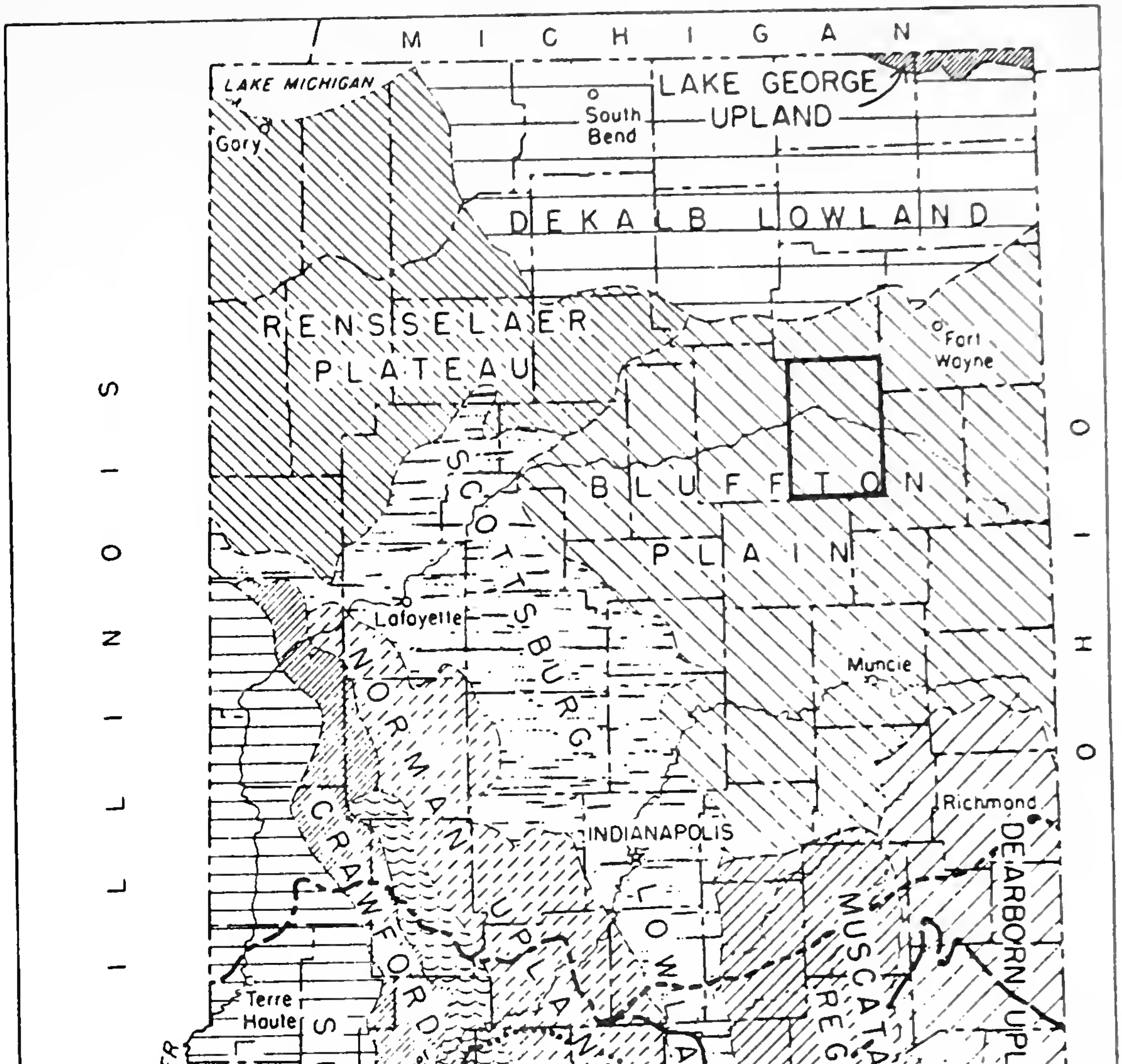


Figure 8. **Map Showing Bedrock Physiographic Units of Indiana and Location of Huntington County. Slightly Modified from Indiana Geol. Survey Rept. Prog. 7, fig. 3 (13)**

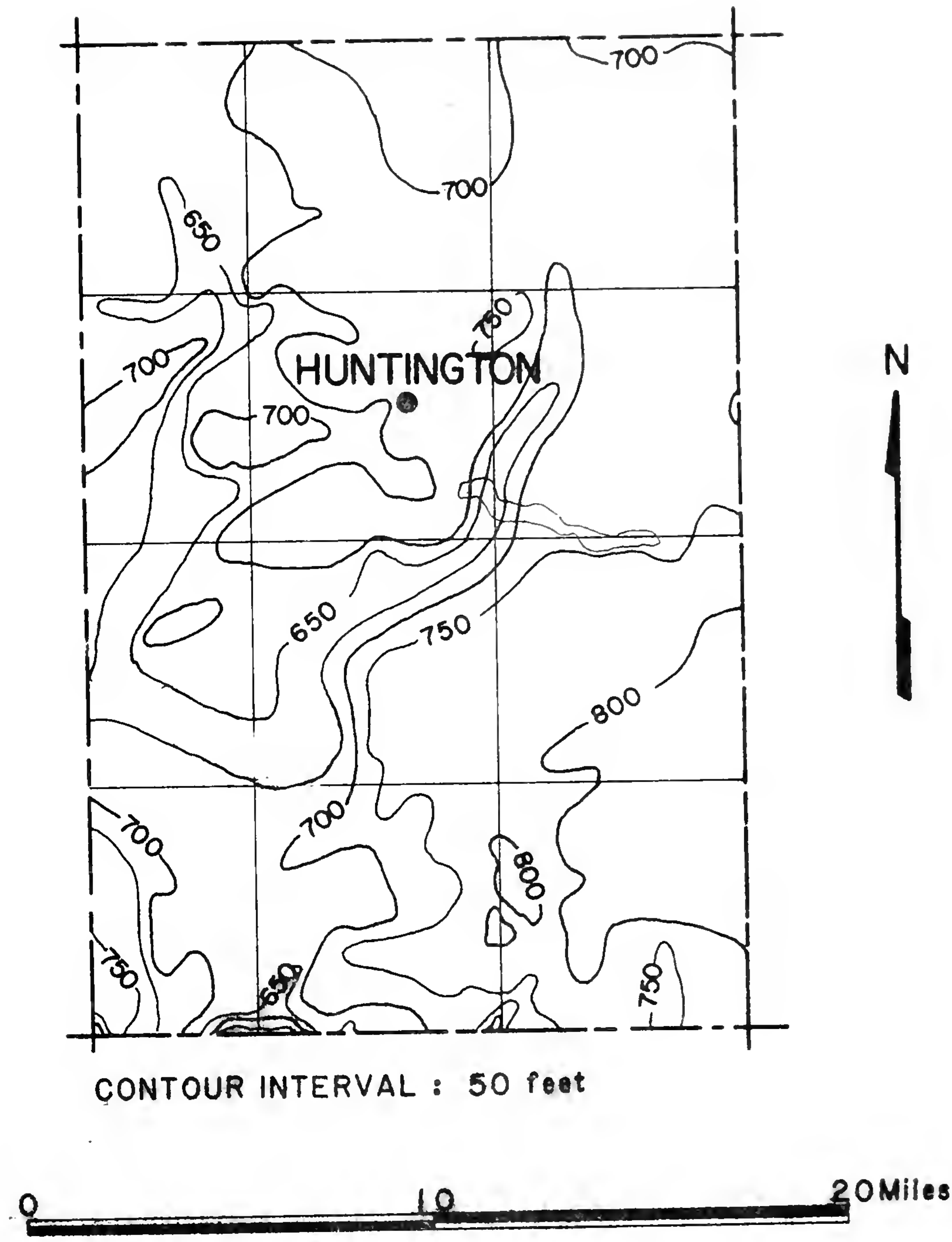


Figure 9. Bedrock Topography Map of Huntington County, Indiana (17)

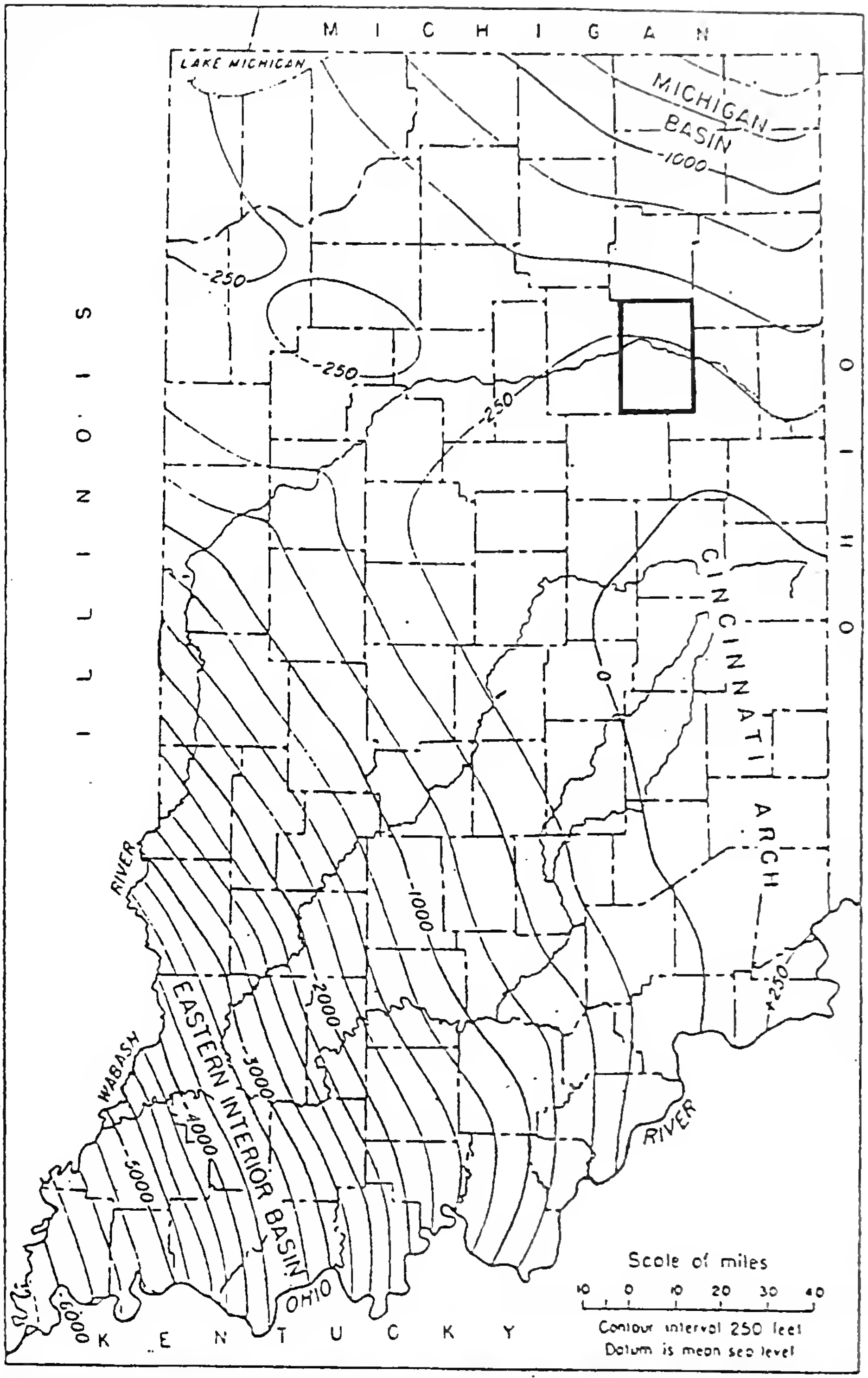


Figure 10. Map of Indiana Showing Regional Bedrock Structure as Defined by Surface of Trenton Limestone and Location of Huntington County (7)

disappears again beneath about 10 to 15 feet of drift. Limestone bedrock reappears about a mile or so downstream and is exposed intermittently to the Wabash County line. Another quarry is located about two miles northeast of downtown Huntington.

The limestone exposed along the old Maumee Sluiceway is apparently at the crest of a small anticline known as the Wabash Arch (14). Beds dip away to the north and south from the valley at about 45^{o}. Erosion of the bedrock has occurred in on almost breached-anticline fashion. Bedding is massive near the town of Mardenis, becoming thinner to about two inches toward the Wabash County line. The limestone observed at the surface close to the Wabash County line was highly fractured and deeply weathered.

Several small bioherm reefs called klintar (11) are exposed along the Wabash River valley near the western county line. These reefs vary in size from a few hundred acres to less than five acres. A small klint (singular) was encountered by the author on US 24 about 300 yards west of county road 900 west. The reefs are generally dome-shaped and are composed of a massive, unstratified, dolomitic core of stromatoporoid, coral, bryozoan, and algae remains. The flank beds dip about 45 to 65 degrees near the core, flattening to about three degrees some distance away from the center. The flank beds are highly fractured and contain numerous faults with slickensides. The reefs, particularly the cores, are very resistant to erosion and were consequently left exposed by the meltwaters which scoured away the more easily eroded drift and the underlying, `softer´

limestone that surrounds the reefs. Numerous klintar are found along the Wabash River valley in neighboring Wabash County, an area recognized as the `type location´ of these features by many geologists.

Shale benches were found along the Wabash River in Wabash County (11), however, no pedalogical soils found in Huntington County were supposedly underlain by shale according to the SCS soil survey and no shale was found exposed at the surface by the author. Ward(12) writes of a dolomitic shale exposed intermittently along the Wabash River east of the junction with the Little Wabash River. The author did note an increase in clay content in the limestone or dolomite toward the Wabash County line as evidenced by the thinner bedding associated with clayey laminae observed in some Wabash River tributary valleys.

GENERAL MAPPING METHOD

ENGINEERING SOIL AREAS

The preliminary steps of the mapping procedure included assembling a photomosaic of Huntington County and marking the county lines and section corners on the mosaic boards. Engineering soil map boundaries of adjacent counties were then located along the county lines and the land form - parent material associations identified. The actual mapping began with the flood plains and proceeded upstream from the Wabash County line. Mapping progressed upward through the terrace deposits into the upland areas of ridge and ground moraine and their associated depressional and stream deposits. The soil boundaries were identified by stereoscopic inspection of the land forms and by surface soil texture as revealed by phototones. The soil boundaries were marked on the mosaic.

The second main phase of the mapping procedure involved grouping of the SCS pedalogical soil series according to land form and parent material and identifying these areas on the agricultural map sheets using a color-code. Preliminary soil boundaries on the photomosaic were then compared with the boundaries on the map sheets and modified as necessary after analytical re-examination of the aerial photographs. Further boundary adjustments were made based on information obtained in the field.

Thirdly, the soil boundaries were transferred from the pictures to a pencil-copy base map using a mechanical reducing device. The scale was reduced from approximately three inches to the mile on the photos to one inch to the mile on the base map. The land form - parent material associations were identified on the pencil base map using a color and symbol code.

The final phase of the mapping procedure was the drafting of the master copy. The engineering soil boundaries were traced from the pencil copy in ink onto the master copy by a draftsperson. The land forms were then identified on the master copy using the standard set of symbols developed for the mapping project. Surface soil texture, (ie., relative composition of sand, silt, clay, etc.), was then superimposed on the land form - parent material associations using the symbols shown in the map's legend. General soil profiles of the engineering soils in Huntington County are shown on the left-hand side of the engineering soils map.

The following discussion is a brief explanation of the land form - parent material areas delineated on the preliminary engineering soil map and the engineering characteristics of the soils associated with the topographic forms within the areas.

Glacial Till Deposits

Ridge Moraine

Parts of the Salamonie and Mississinewa ridge moraines, formed by the Erie Lobe of the Wisconsinan ice sheet, are found

in Huntington County. These moraines generally coincide with the local watershed divides and for the most part are gently rolling, not exhibiting the characteristic rugged topography associated with ridge moraines. There are areas in the north-central part of the county and south of a narrow, generally east-west trending band of the Salamonie moraine in the central part of the county where the terrain more closely resembles the hummocky topography typical of many ridge moraines. Small areas of knob and basin-like topography where relief may exceed 40 feet locally are found in these locations, and deposits of peat and muck are more numerous than elsewhere. Relatively coarser textured knolls (i.e., more sand) are more common in the ridge moraines than in the ground moraine as evidenced in the field, however, there is no apparent relationship between the distribution of probable kames and the ridge and ground moraine, nor is there any such relationship with deposits of peat and muck and highly organic topsoil, with the exception of the two areas previously mentioned. Local relief is generally on the order of 20 to 30 feet in the ridge moraines in Huntington County, Indiana.

The same soil series developed on both the ground and ridge moraine in Huntington County, however, the distribution of these soils between the two land forms shows a marked contrast which is attributed primarily to general differences in topography rather than a substantial variance in parent material (18). The Blount and Pewamo soil series by far account for the greatest areal extent of the land surface in both the ridge and ground moraine,

the former occupying elevated positions in the terrain and the latter the lower-lying areas (2). The Pewamo soil series is more extensive in the ground moraine and soil areas are relatively large, while soil areas in the ridge moraines are smaller and are about equally distributed between the Pewamo series and the Blount and other soil series based on the SCS soil map sheets. Other soils developed on the ridge moraines in Huntington County include the Rawson Variant and Glynwood series on convex rises and knolls and the Haskins Variant and Morley series on intermediate positions (2). These soils are also found in areas of ground moraine but to a much less extent, presumably due to less differentiation of the soils based on topography in the nearly level ground moraine.

The soils developed on knolls and swells in the ridge moraines in Huntington County include the Blount, Glynwood, and Rawson Variant pedalogical soil series (2). The Blount and Glynwood series are characterized by a silty loam (A-4 to A-6) surface soil which extends to a depth of about eight inches. Beneath eight inches is found a silty clay-loam or clay loam (A-4 to A-7). The Rawson Variant soil series is characterized by a sandy loam (A-2 to A-4) soil to a depth of about 35 inches. Beneath the sandy loam is found a clay loam (A-6 to A-7). Samples taken in the field from ridge moraine swells revealed a sandy surface soil which was underlain by a silty clay-loam type soil at a depth of about 10 inches to about 15 to 25 inches. A silt loam soil was found beneath to a depth of about 30 inches.

This description is only general and is based on hand examination of a limited number of field samples.

Low-lying areas in the ridge moraines are usually connected in a network of sluiceways and draws with few isolated swales. The dominant soil series developed on the lower topographic positions is the Pewamo as determined from the SCS map sheets. Isolated areas of the Patton (Pe variation, see Appendix A-1) and Houghton (organic) soil series are found in the deeper depressions. These soils developed in deposits of shallow-water lacustrine sediments and organic matter, discussed separately in the text under `Depressional Deposits´. The Haskins Variant soil series is found in close association with the Pewamo series and was referred to in the development of the general soil profile for `Low´ areas in the ridge moraines shown on the left-hand side of the engineering soils map of Huntington County.

The Pewamo soil series developed most widely in the low topographic positions and is characterized by a silty clay-loam (A-6 to A-7) soil with a few pebbles throughout the soil profile (2). The Haskins Variant series developed on slightly sloping (1 to 4 percent) ground adjacent to Pewamo soils and is characterized by a fine sandy loam (A-4) surface soil to a depth of about 10 inches. The surface soil is underlain by a sandy loam (A-2-4 to A-4), a loam (A-4 to A-6) soil, or a silty clay-loam (A-6) to a depth of about 31 inches beneath which is found a clay loam (A-6) with some gravel. The percent areal distribution of the ridge moraine soils is given in Table 3 along with the

TABLE 3. ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
ApA	Aptakisic silt loam, 0 to 2 percent slopes	474	0.2
BcB2	Blount silt loam, 1 to 4 percent slopes, eroded	92,579	37.1
ChB	Chelsea loamy sand, 3 to 12 percent slopes	182	0.1
Ee	Eel silt loam, occasionally flooded	2,622	1.1
FoA	Fox loam, 0 to 2 percent slopes	316	0.1
FoB	Fox loam, 2 to 6 percent slopes	596	0.2
FoC2	Fox loam, 6 to 12 percent slopes, eroded	284	0.1
Ge	Genesee silt loam, occasionally flooded	2,580	1.0
GlB2	Glynwood silt loam, 3 to 7 percent slopes, eroded	11,402	4.6
HcA	Haskins Variant fine sandy loam, 1 to 4 percent slopes	1,536	0.6
HeO	Hennepin loam, 30 to 70 percent slopes	2,762	1.1
Ho	Houghton muck, drained	413	0.2
McA	Martinsville silt loam, 0 to 2 percent slopes	1,319	0.5
McB	Martinsville silt loam, 2 to 8 percent slopes	1,857	0.8
Ms	Millsdale silty clay loam	2,130	0.9
MtA	Milton silt loam, 0 to 2 percent slopes	781	0.3
MtB	Milton silt loam, 2 to 6 percent slopes	804	0.3
MtC	Milton silt loam, 6 to 15 percent slopes	311	0.1
MxC2	Morley silt loam, 6 to 12 percent slopes, eroded	13,554	5.4
MxD2	Morley silt loam, 12 to 18 percent slopes, eroded	4,063	1.6
MxE2	Morley silt loam, 18 to 30 percent slopes, eroded	1,223	0.5
MzC3	Morley clay loam, 6 to 12 percent slopes, severely eroded	2,219	0.9
MzD3	Morley clay loam, 12 to 18 percent slopes, severely eroded	1,041	0.4
OcA	Ockley loam, 0 to 2 percent slopes	1,032	0.4
OcB	Ockley loam, 2 to 6 percent slopes	336	0.1
Pa	Patton silty clay loam	2,096	0.8
Pe	Patton silty clay loam, sandy substratum	4,921	2.0
Pg	Pewamo silty clay loam	75,374	30.2
Px	Pits, gravel	187	0.1
Py	Pits, quarry	139	0.1
RcA	Randolph loam, 0 to 2 percent slopes	3,574	1.4
RgB	Rawson Variant fine sandy loam, 2 to 6 percent slopes	1,421	0.6
RgC	Rawson Variant fine sandy loam, 6 to 12 percent slopes	331	0.1
Rk	Rensselaer loam	3,050	1.2
Sh	Shoals silt loam, occasionally flooded	5,259	2.2
Sm	Sloan silt loam, frequently flooded	244	0.1
Ud	Udorthents, loamy	1,033	0.4
Wo	Whitaker loam	1,998	0.8
	Water	3,557	1.4
	Total	249,600	100.0

distribution of all the soil types subsequently mentioned with regard to the other land form - parent material associations in Huntington County.

Ground Moraine

The ground moraine in Huntington County is, for the most part, flat and featureless, broken occasionall by stream courses and sluiceways and shallow depressions or low knolls. Soil areas are generally large relative to those in the ridge moraine due to less soil differentiation based on topographic variation in the ground moraine. The Blount and Pewamo soil series dominate (see Table 3) the landscape based on the SCS map sheets, with lesser amounts of the Patton (Pe) (See Addpendix A-1) series and only minor inclusions of the Glynwood, Rawson Variant and Haskin Variant series. The latter of those series along with the Hennepin and other soil series developed primarily in areas of ground moraine associated with stream dissection where local relief was greater. Ground moraine occupies most of the surface area in Huntington County, followed by ridge moraine.

The Blount soil series developed almost exclusively on the swells in the ground moraine of Huntington County. This series is characterized by about eight inches of a silt loam (A-4 to A-6) surface soil which is underlain to a depth of about 30 inches by a silty clay-loam (A-6 to A-7) soil (2). Beneath about thirty inches is found a clay loam (A-6 to A-7).

The Pewamo soil series is the predominant series developed in the swales and low-lying areas in the ground moraine in Huntington County. The Houghton (organic) and Patton (lacustrine) soil series also developed in some low-lying areas in the ground moraine, however, they are discussed under `Depressional Deposits´ and are identified with unique symbols on the engineering soils map that accompanies this report. The Pewamo soil series is characterized by silty clay-loam (A-6 to A-7) soil throughout the soil profile (2). Boreholes 82, 85, 87, 92 and 93 in ground moraine swales along I-69 indicate a general soil profile consisting primarily of clay, clay loams, and silty clay-loams (A-6 to A-7). Blount and Pewamo soils, the primary constituents of the ground and ridge moraine in Huntington County, account for a combined 67.3 percent of the total county surface area (2). Ridge and ground moraine cover more than 80 percent of the county with the addition of the Morley, Haskins Variant, and other minor soil series developed on the two Wisconsinan age glacial land forms.

Glacio-Fluvial Deposits

Outwash Plains and Terraces

Outwash terraces are located along the Wabash River, the Little Wabash River, and the Salamonie River and on Clear Creeks and Creek in Huntington County. These deposits are composed primarily of meltwater sands and gravels and occupy somewhat higher positions in the landscape than recent river terraces (ie., from

about 25 to 50 feet above the present day flood plains). They are up to a mile in width, as is the case within the large meanders just southeast of the Salamonie Reservoir on the Salamonie River, and are found adjacent to the valley walls or on circum-navigated `islands´ in some places. The outwash plain deposits shown on the engineering soils map are all located on the floor of the old Maumee sluiceway above the flood plain (and any recent river terraces) and below the outwash terraces or the valley wall. Outwash plain deposits are composed primarily of meltwater sands and gravels and the same pedalogical soil series developed on both the plains and terraces. The outwash plains were, however, affected more by recent stream erosion and alluvial deposition due to their lower position in the landscape and proximity to the flood plain of the Little Wabash River and the Wabash River. Due to limited access and time for field sampling, some areas indicated as outwash terraces on the engineering soils map are probably water-reworked till and vice-versa, as these deposits occupy similar positions in the terrain. The more level and granular areas exhibiting current marks and infiltration basins on the aerial photographs were considered outwash terraces while less level areas that had a washed or scoured appearance along the valley walls were mapped as water-reworked till. Some mapping discrepencies obviously must exist.

Pedological soil series that developed on the outwash plains and terraces include the Fox, Ockley, Aptakisic, and Martinsville. These soils are generally characterized by a loam or silt

loam (A-4 to A-6) surface soil that extends to a depth of about 10 to 15 inches which is underlain to a depth of 24 to 36 inches by a loam or sandy loam (A-2 to A-6) or a gravelly-sandy loam (A-2 to A-7) subsoil (2). Beneath about 36 to 42 inches is found gravelly coarse sand (A-1 to A-3) with cobbles and boulders or a sandy loam (A-2 to A-4) with some cobbles. The Aptakisic soil developed in outwash deposited by slow moving or ponded water and occupies the low-lying positions in areas of outwash sediments. This soil is less coarse in texture than the others and is generally characterized by about nine inches of a silt loam (A-4 to A-6) surface soil which is underlain by a silty clay-loam (A-6 to A-7) subsoil to a depth of 34 inches. Beneath the subsoil is found stratified fine sandy loam (A-2) or a silty loam (A-4).

Gravel content below 36 inches is as much as 58 percent or more (2). The presence of numerous cobble and boulder-sized rock fragments in the outwash parent material was verified by roadway soil survey borehole logs.

Kames

No definite kames and no eskers were located in Huntington County based on comparison of the stereoscopically determined soil boundaries on the photomosaic boards with the SCS soil map sheets using the method as discussed under `GENERAL MAPPING METHOD´. The more prominent knolls in the county were identified on the soils map as possible kames regardless of the lack of certainty about them because granular material (i.e., sandy silt or

clay with some gravel) is still more likely to be found in these hill forms than elsewhere in the till plain areas. The location of these prominent, local topographic highs benefits the engineer even if they are only coarse-textured till knobs and not deposits of glacio-fluvial sand and gravel. The reader is referred to the general soil profile for outwash terraces on the engineering soils map for a general idea about the composition of these knolls identified as possible kame land forms.

Sluiceways

Sluiceways of both recent and meltwater origin are found in Huntington County. Those of meltwater origin are primarily located in areas of knob and basin topography, on the outwash plains and terraces, and in rugged areas of ridge moraine, while sluiceways of recent age are associated with the upper reaches of stream valleys, (ie., lower order streams), near the watershed divides. The major sluiceway systems are associated with Pony Creek in the northwest corner of the county, Loon and Majenica Creeks in the central part of the county, and Logan and Richland Creeks in the southwestern part of Huntington County.

The pedalogical soil series developed in sluiceways over till include the Pewamo and Rensselaer. The Rensselaer series is more coarse in texture and formed primarily in the larger meltwater sluiceways while the Pewamo soil developed most commonly over sluiceways of recent origin in less coarse sediments. The Pewamo soil series consists of a silty clay-loam (A-6 to A-7) with some

pebbles throughout the soil profile (2). The Rensselaer series is generally characterized by 6 to 10 inches of a loamy (A-4 to A-6) surface soil which is underlain by 10 to 14 inches of a loam (A-6 to A-7) soil and 10 to 12 inches of a clay loam (A-6 to A-7) subsoil to a depth of about 36 inches. From 36 to about 45 inches is found a loamy (A-6) soil which is underlain by a loam soil (A-2 to A-4) with lenses of sand. The Rensselaer and Martinsville soil serices are the primary soils developed in sluiceways on terraces and on outwash and lacustrine plain deposits in the Maumee Sluiceway in Huntington County. A profile for sluiceways over alluvial plains is shown on the left-hand side of the engineering soils map that accompanies this report.

Recent Fluvial Deposits

Flood Plains

Flood plain deposits consist of stratified alluvial sediments of recent age and are found along the Salamonie, Wabash, and Little Wabash Rivers and their major tributaries, particularly Silver, Clear, Loon, and Richland Creeks in Huntington County. The flood plains range in width from nearly half a mile in some places on the three principal rivers to a few hundred feet at points on some of their smaller tributaries. The flood plain of the Little Wabash River narrows to virtually the immediate course of the stream in the limestone area around the City of Huntington. A similar condition exists along the Wabash River near Markle and at places along the Salamonie River.

Most of the short, (ie., less than one half mile), tributary flood plains shown on the engineering soils map are not true flood plains due to steep gradients, however, they were indicated as such in order to show the location of these deeply eroded stream valleys or gulleys through which water frequently flows, and to maintain the continuity of the true flood plains of the major streams. Although stream action in the steep tributary valleys is primarily erosional, some alluvial sediment is, of course, deposited along these short tributaries and small alluvial fans are common where these streams empty onto the floor of the broad, flat, Maumee Sluiceway. Colluvial deposits are found on the slopes of the steep tributary valleys and, in places, at the base of the Maumee sluiceway valley walls, particularly near alluvial fans and of water-reworked till. Recent alluvium is intermixed with thin outwash over limestone bedrock and with slackwater lacustrine deposits along the Maumee sluiceway channel due to occasional flooding during periods of extreme high water. Areas beneath the Huntington and Salamonie Reservoirs were former flood plains unless otherwise indicated on the engineering soils map that accompanies this report.

Pedalogical soil series developed on flood plains in Huntington County include the Eel, Genesee, Shoals and Sloan (2). These soils are generally characterized by 13 to 18 inches of a silt loam (A-4 to A-6) surface soil which is underlain to a depth of 30 to 36 inches by a loam or silt loam soil (A-4 to A-7) with thin (1/4 to 1/2 inch) layers of sandy loam (A-4). From about 36

inches to 48 inches is found a silt loam, sandy loam, or sandy silt loam (A-4 to A-6) soil which is underlain by loam or sandy clay-loam (A-4 to A-6) or gravelly-sandy loam (A-4). Gravel content ranges up to 16 percent beneath about 48 inches of overburden in areas of the Shoals soil series.

Within the river channels, limestone or dolomite bedrock is overlain by less than one foot to more than 35 feet of alluvial material in some places based on roadway soil survey boreholes data. Shallow limestone bedrock is most likely to be found beneath flood plains adjacent to areas identified on the map as "thin outwash, recent alluvium, and residual soil over limestone-dolomite bedrock" (see accompanying map). For additional information on limestone bedrock encountered beneath alluvial deposits in Huntington County, the reader is referred to Appendix B, particularly part II in the back of this report.

Recent River Terraces

Recent river terraces are found along the Wabash River, the Little Wabash River, and Salamonie River and their major tributaries in Huntington County. These terraces are composed primarily of stratified alluvial silt, sand, and gravel with lesser amounts of clay. They are located immediately adjacent to and about 10 to 20 feet above the flood plains and range up to about one-third of a mile in width. Recent river terrace material consists of both recently eroded sediment and reworked outwash sands and gravels. Some recent river terraces now lie beneath the high

water marks of the Huntington and Salamonie Reservoirs.

Pedalogical soil series developed on recent river terraces in Huntington County are the Martinsville, Ockley, Rensselaer, and Whitaker (2). These series are generally characterized by a loam or silt loam (A-4 to A-6) surface soil which is underlain by clay loam (A-6 to A-7) or sandy loam (A-2 to A-6) subsoils to a depth of about 36 to 38 inches. Between about 38 and 56 inches is usually found a sandy loam (A-2 to A-4) or a gravelly sandy clay-loam (A-6 to A-7) beneath which is generally found gravelly sand (A-1) or a loamy or gravelly clay-loam (A-2 to A-4) soil with thin (< 1/2 inch) sandy lenses. Gravel content ranges up to 35 percent or more beneath about 38 inches and roadway soil survey borehole logs indicate cobbles and boulders are not uncommon in the underlying parent material of the recent river terraces, particularly in areas where limestone is at relatively shallow depth (ie., near areas indicated as thin outwash, recent alluvium, and residual soil over limestone/dolomite bedrock on the engineering soils map).

Water-Reworked Till

Areas of water - reworked till are found throughout Huntington County adjacent to sluiceways, rivers, and streams. These deposits consist of till which was subject to sheet-wash or was commonly scoured by water during periods of seasonal flooding or after heavy rainfall, resulting in a surface soil generally more coarse in texture than the surrounding, unaffected till. Water -

reworked till is primarily a product of erosion and the resorting of existing material rather than deposition, a characteristic which seperates it from the lower-lying alluvial material and the higher ridge or ground moraine. Many of the short, steep tributaries to the old Maumee Sluiceway channel and the Salamonie River and Wabash River valleys would probably be better characterized as water - reworked till, based on the nature of the soils along these gullies. However, they were designated as flood plains on the engineering soils map for reasons already discussed in the `Flood Plains´ section of this report.

Soil developed on water - reworked till in Huntington County include the Hennepin, Haskins Variant, and Rensselaer pedalogical soil series. The Hennepin soil is the most common series developed on steeply (30 to 70 percent) sloping areas of water - reworked till and is characterized by a loamy (A-4 to A-7) soil throughout the profile. Some sandy layers are incorporated in the soil profile and gravel content ranges up to five percent. The Haskins Variant and Rensselaer soils are characterized by about 12 inches of a loam or sandy loam (A-2 to A-4) surface soil. The subsoil of the Rensselaer series is a loam, silt loam, or clay loam (A-6 to A-7) which is underlain at a depth of about 46 inches by a loam with sandy layers (A-2 to A-4). The subsoil of the Haskins Variant series is a loam or clay loam (A-4 to A-6) which is underlain at a depth of about 36 inches by a clay loam (A-6) with up to nine percent gravel.

Field observations made in an area of water - reworked till indicate a sandy surface soil with numerous cobbles and some boulders. Pedalogical soils developed adjacent to areas of water - reworked till includes the Martinsville and Whitaker series, and Udorthento soils developed on cut and fill areas.

Unconsolidated Deposits Over Limestone-Dolomite Bedrock

Thin Outwash, Recent Alluvium, and/or Residual Soil Over Limestone-Dolomite Bedrock

Thin (ie., 20 to 30 inches) glacial outwash is intermixed with recent alluvium above limestone/dolomite bedrock and any overlying residual soil along the Wabash River, the Little Wabash River, and the Salamonie River and along Rock Creek in Huntington County, Indiana. These deposits are primarily found in the form of low-lying plains in the Old Maumee sluiceway channel. They are also found in bench-like fashion along the Wabash River and Rock Creek near the town of Markle and in a small area on the Salamonie River just southeast of Warren. Planar areas of limestone/dolomite bedrock at shallow depth in the Maumee Sluiceway were not easily distinguishable from low-lying outwash and slackwater lacustrine plains, or recent river terrace deposits on the aerial photographs. Similar difficulty was encountered distinguishing terraces from limestone/dolomite benches. Liberal use was made of the SCS soil survey map sheets (2) using the color-coding system and boundary modification procedure as described in the `MAPPING METHOD' section. Many of the areas determined to be underlain at a shallow depth by

limestone/dolomite bedrock on the map sheets and aerial photographs were verified by roadway soil survey borehole data.

The Millsdale, Milton, and Randolph pedalogical soil series developed on areas underlain at shallow depth by limestone/dolomite bedrock in Huntington County, Indiana (2). The Millsdale soils occupy the lower-lying positions while the Randolph and Milton series occupy intermediate and elevated positions, respectively in the landscape according to the agricultural map sheets. These soils are generally characterized by a loam or silt loam (A-4 to A-6) or silty clay-loam (A-6 to A-7) surface soil to a depth of about 7 to 15 inches. The subsoil is a clay loam (A-6 to A-7) or silty clay (A-7) which extends to limestone or dolomite bedrock at a depth of about 25 inches. Gravel or cobble-sized rock fragments are not uncommon within the soil profile and are more common on the surface than on the lacustrine plains based on limited field observations. Organic matter content ranges up to seven percent (2). Similar soils developed on the so-called klintar or limestone reefs previously discussed in the bedrock section. However, the klints are described separately as a unique land form.

<u>Limestone Reefs (Klintar)</u>

Several limestone reefs, or klintar, are exposed in the Wabash sluiceway near the Wabash County line. The general nature of these limestone reefs and their likely mode of formation are discussed in detail under the bedrock section of the report and

are not here covered.

The primary pedalogical soil series developed on the reefs in Huntington County is the Milton according to the SCS map sheets (2). This soil series is characterized by a silt loam (A-4 to A-6) surface soil that extends to a depth of about seven inches. The subsoil, a clay loam (A-6 to A-7) which contains residual gravel and cobble-sized rock fragments, overlies limestone/dolomite bedrock found at a depth of about 25 inches. The author investigated several of the `klintar´ on the field trip and found that the overburden thickness varied from less than half a foot to about two and one-half to three feet. The surface of the ground was uneven and not easily traversed, presumably due to solutioning effects in the underlying limestone. No true sinkholes were identified in the field, however, some small, possible sinkholes were observed on the aerial photographs. What appeared to be weakly defined concentric rings discerned on the aerial photographs on the two largest klintar in the county presumably were the surficial expression of the internal structure of the reef formations as exposed by weathering and erosion.

The reader is referred to the general soil profile of thin outwash, recent alluvium, and residual soil over limestone/dolomite bedrock for an idea of what kind of soil profile might be expected over the klintar. The klintar are, however, identified on the engineering soils map by a separate symbol as a unique land form.

Depressional Deposits

Lacustrine Plain or Slackwater Plains

Lacustrine plains of both shallow lake and slackwater origin are found in Huntington County. The shallow water lacustrine plains are found in the uplands and range in size from a few acres to an area of more than one square mile as indicated in Section 26, T28N, R10E and parts of surrounding sections. The slackwater plain in Huntington County is located along the Little Wabash River in the old Maumee Sluiceway channel and is up to a mile wide in some places. One explanation of the origin of this slackwater plain is suggested under the `Glacial Geology´ section of this report. The lacustrine plains and slackwater plains are generally flat and featureless and commonly require trenches to improve sluggish drainage. No beach ridges occur on the edge of these lacustrine plains or slackwater plains.

Two different variations of the Patton soil series developed on the lacustrine plains of Huntington County; the silty Patton series developed primarily on the slackwater lacustrine plains while the more sandy Patton soil developed on both the shallow water and slackwater plains (2). The silty Patton soil is characterized by a silty clay-loam (A-6 to A-7) soil throughout its profile. The sandy Patton soil is generally characterized by about 45 to 50 inches of a silty clay-loam (A-6 to A-7) surface and subsoil which is underlain by a sandy loam or sandy clay-loam soil (A-2 to A-6). A borehole(#88 on the map) along I-69 in the

large, shallow-water lacustrine plain previously mentioned showed the following soil profile:

0.0′ to 2.0′ black clay, A-7-6(19), P.I.= 31,

2.0′ to 4.0′; brown clay, A-6(10), P.I. = 14.

Organic matter content ranges up to six percent or more (2).

Peat and Muck Depressions

Deposits of peat and/or muck are found in Huntington County in kettle-like, ice block, and other depressions in the glacial till and along sluiceways and in low-lying areas in stream valleys. The areas range in size from nearly 3/4 of a mile in length and more than 60 to 70 acres to less than 5 acres. Elongate patches of peat or muck are concentrated and somewhat aligned on the edge of a band of ridge moraine south of Loon Creek in the central part of the county and in Section 11, T26N, R8E in ground moraine in the southwest part of the county. There is also a concentration of depressional deposits, many of them containing peat and/or muck, in the north-central part of the county. These depressions are found primarily in the ridge moraine in the area. Elsewhere, however, there is no apparent relationship between ridge and ground moraine and the relative distribution of peat and muck.

The soil series that developed on deposits of peat and/or muck in Huntington County was the Houghton. This series is characterized by a highly organic silty clay surface soil (i.e.,

up to 15% organic matter) to a depth of about 22 inches which is underlain by peat and/or muck (A-8) (2). Organic matter content of the peat and muck ranges up to 75 percent or more. Houghton soil areas comprise less than 0.2 percent of the county surface, but knowledge of the location of these deposits is of importance to the engineer due to the high compressibility of the organic matter. Peat and muck, like glacio-fluvial lenses of sand and gravel, are incorporated in the till and can only be identified in the subsurface by drilling.

Highly Organic Topsoil Depressions

Highly organic topsoil is found throughout Huntington County in areas ranging in size from a few acres to several of acres. Highly organic topsoil is commonly associated with or on the fringes of deposits of peat or muck and shallow or slackwater lacustrine sediments. Like deposits of peat and muck areas of highly organic topsoil are fairly well distributed throughout the county and are anomalously more numerous only in those areas described for peat and muck, particularly in the north-central part of the county.

The most common soil series containing highly organic topsoil in Huntington County included the Patton and Pewamo. The soil profile of both series is composed primarily of a silty clay-loam (A-6 to A-7), however, the Patton surface soils are underlain in many places by stratified fine sand or sandy clay-loam (A-2 to A-6) (2). Organic matter content in the surface

soil ranges from about 3 to 6 percent or more. The Millsdale and Patton (Pa) soil series are also commonly characterized by highly organic topsoils.

Eolian Sands

Sand Dunes

Several minor, incipient sand dunes were located in Huntington County in, adjacent to, and north of the old Maumee sluiceway channel where it is occupied by the Little Wabash River. These small areas of eolian sands do not exceed about 10 to 15 feet in height and were located on the aerial photographs only after referring to the SCS map sheets and looking for the Chelsea soil series which developed on them. They are really not sand dunes at all in the classical sense, but simply isolated, randomly shaped areas where minor amounts of wind-blown sand accumulated. The most dune-like formations are located in section 14, T29N, R10E along the Little Wabash River on the floor of the Maumee sluiceway.

The Chelsea soil series developed on the deposits of eolian sand and accounts for less than 0.1 percent of the county area. This soil series is characterized by a loamy sand (A-2 to A-3) to a depth of about 54 inches which is underlain by sand (A-2-4) (2). Gravel content ranges up to 10 percent or more in the underlying material in areas where the dunes formed over fluvial deposits. Where the `dunes´ formed in ridge or ground moraine

the sandier eolian soils eventually grade in to the silty clay soils of the till. The general locations of the eolian deposits are identified on the engineering soils map by the standard crescent moon-shape used for dune deposits.

Miscellaneous Information

Sand and Gravel Pits

Sand and gravel pits are found throughout Huntington County along streams and sluiceways, particularly along the Wabash River, Little Wabash River and the Salamonie River and their larger tributaries. Sand and gravel pits were not checked in the field for grain size distribution and due to the great variability of fluvial deposits, no definite determination was made as to what pits contain what size functions and what proportion. However, in general, pits located in flood plains and along shallow streams more likely produce greater amounts of sand while those in terrace and outwash plains probably produce more gravel. Some of the pits shown on the map that were identified on the 1937 aerial photographs are probably abandoned, however, they are shown on the map in order to indicate those areas where additional sand and gravel might be found. Some of the abandoned operations were partially or wholly filled with water. Numerous pits identified on the SCS soil map sheets are also shown on the map, many of which are probably still in operation.

A gravel sample taken from a pit located in an outwash terrace along the Wabash River near where Silver Creek joins it

showed the following grain size distribution:

Table 4. Grain Size Analysis of a Gravel Sample from a Pit on the Wabash River, Huntington City, Indiana (19).

Percent		Size Distribution of Gravel Fraction		
Sand	Gravel	0.25 to 0.5 in.	0.5 to 1.0 in.	Plus 1.0 in.
54%	46%	28%	23%	49%

Quarries

Two limestone quarries were located in Huntington County as well as several abandoned operations. One is located just northwest of Bowerstown in the Old Maumee Sluiceway channel and the other is located about a mile or so southwest of the town of Markle on Rock Creek. There were several small bodies of water in the Wabash River Valley in the town of Markle and near the operation in the Maumee sluiceway that were inferred to be old quarry locations. The limestone quarried was crushed and used as aggregate for concrete, for roadstone, and as a source of agricultural lime (20).

Cut and Fill Areas

Numerous cut and fill areas were located in Huntington County on the SCS map sheets and are shown on the engineering

soils map. They are identified by a diagonal cross-hatched pattern shown in the legend on the right-hand side of the map. No profile is given for these areas, however, they are shown on the map in order to indicate where the natural soils were distrubed.

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Appendix A-1.ESTIMATED ENGINEERING PROPERTIES(2)

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
ApA-----------------Aptakisic	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	95-100	95-100	80-100	25-40	5-15
	9-34	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	60-100	35-55	20-40
	34-60	Stratified fine sandy loam to silt loam.	ML, CL, SM, SC	A-2, A-4	0	95-100	95-100	90-100	30-90	20-30	NP-10
BcB2-----------------Blount	0-8	Silt loam--------	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	8-24	Silty clay loam, silty clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	90-100	80-95	35-60	15-35
	24-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	90-100	90-100	80-100	70-90	30-45	10-25
ChB-----------------Chelsea	0-7	Loamy sand-------	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	7-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
Ee-----------------Eel	0-7	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	75-85	26-40	3-15
	7-13	Silt loam, loam	ML, CL	A-4, A-6	0	100	100	90-100	75-85	26-40	3-15
	13-60	Stratified sandy loam to silty clay loam.	ML, CL	A-4, A-6	0	100	90-100	70-80	55-70	26-40	3-15
FoA, FoB, FoC2---Fox	0-8	Loam-------------	ML, CL, CL-ML	A-4	0	95-100	85-100	75-95	55-90	20-30	3-10
	8-30	Gravelly clay loam, loam, gravelly sandy clay loam.	CL, SC	A-2, A-6, A-7	0-5	85-100	70-95	50-95	20-65	25-45	10-25
	30-60	Stratified sand to gravel.	SP, SM, GP, GM	A-1, A-2, A-3	0-10	40-100	35-100	15-95	2-20	---	NP
Ge-----------------Genesee	0-18	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	75-90	26-40	3-15
	18-25	Silt loam, loam	ML, CL	A-4, A-6	0	100	100	90-100	75-90	26-40	3-15
	25-60	Stratified sandy loam to silt loam.	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	60-90	50-90	20-35	3-15
OlB2-----------------Olynwood	0-7	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	90-100	80-100	55-90	23-40	4-15
	7-30	Clay, clay loam, silty clay loam.	CL, CH	A-7, A-6	0-5	95-100	85-100	75-100	65-95	35-55	15-30
	30-60	Clay loam, silty clay loam.	CL	A-6, A-4	0-5	95-100	80-100	75-95	65-90	25-40	7-16
HcA-----------------Haskins Variant	0-10	Fine sandy loam	SM, SM-SC, SC	A-4	0	95-100	90-100	60-85	35-55	<25	NP-7
	10-31	Sandy loam, loam	SC, CL	A-4, A-2-4, A-6	0	95-100	90-100	50-95	25-75	20-30	7-12
	31-60	Clay loam, silty clay loam.	CL	A-6	0-5	95-100	95-100	85-100	65-95	30-40	10-15
HeG-----------------Hennepin	0-5	Loam-------------	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	70-100	60-95	25-40	5-20
	5-14	Loam, sandy loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25
	14-60	Loam, sandy loam, clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	80-100	65-100	35-95	20-50	5-25
Ho-----------------Houghton	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
McA, McB---------Martinsville	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-90	22-33	4-12
	8-31	Clay loam, loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	90-100	65-90	40-90	20-35	8-20
	31-47	Sandy loam, sandy clay loam, loam.	SM, ML	A-2-4, A-4	0	100	90-100	60-80	30-60	30-40	2-8
	47-60	Stratified sand to sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4	0	95-100	85-100	80-95	40-60	<25	4-9

Appendix A-I, continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ms----------------- Millsdale	0-14	Silty clay loam	CL	A-6, A-7	0	90-100	80-100	75-100	60-95	32-50	12-25
	14-25	Clay, channery silty clay loam, silty clay loam.	CH, CL	A-7	0-5	85-100	80-100	75-100	60-95	40-60	20-35
	25	Unweathered bedrock.									
MtA, MtB, MtC---- Milton	0-7	Silt loam--------	ML, CL	A-4, A-6	0	95-100	90-100	85-100	70-95	26-36	4-12
	7-13	Silty clay loam, clay loam, clay.	CL	A-6, A-7	0	95-100	80-100	75-100	70-95	32-48	12-28
	13-24	Clay, sandy clay loam, channery clay loam.	CH, CL	A-7, A-6	0-5	95-100	80-100	70-95	50-90	32-55	14-33
	24	Unweathered bedrock.									
MxC2, MxD2, MxE2- Morley	0-7	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	75-95	25-40	5-15
	7-28	Silty clay loam, clay loam, clay.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
	28-60	Silty clay loam, clay loam.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-30
MzC3, MzD3------- Morley	0-4	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	80-90	30-45	15-25
	4-25	Silty clay loam, clay loam, clay.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
	25-60	Silty clay loam, clay loam.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-30
OcA, OcB--------- Ockley	0-8	Loam-------------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	3-12
	8-40	Fine sandy loam, clay loam, sandy loam.	CL, CL-ML, ML, SM	A-6, A-4 A-2	0	100	75-100	45-100	20-80	15-40	3-15
	40-55	Gravelly clay loam, gravelly sandy clay loam.	CL, SC, GC	A-6, A-7	0-2	70-85	45-75	40-70	35-55	30-50	15-30
	55-60	Stratified sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	20-55	5-20	2-10	---	NP
Pa---------------- Patton	0-8	Silty clay loam	CL	A-6	0	100	100	95-100	75-95	30-40	15-25
	8-44	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	80-100	40-55	15-25
	44-60	Stratified loam to silty clay loam.	CL	A-6	0	100	100	95-100	75-95	25-40	10-20
Pe---------------- Patton	0-18	Silty clay loam	CL	A-6	0	100	100	95-100	75-100	30-40	10-20
	18-47	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	80-100	30-45	10-25
	47-60	Stratified fine sand to clay loam.	ML, CL, SM, SC	A-4, A-6, A-2-4, A-2-6	0	100	95-100	60-100	20-80	<35	NP-15
Pg---------------- Pewamo	0-12	Silty clay loam	CL	A-6, A-7	0-5	90-100	80-100	80-100	70-90	35-50	15-25
	12-36	Clay loam, clay, silty clay loam.	CL, CH	A-7, A-6	0-5	95-100	90-100	90-100	75-95	35-55	15-30
	36-60	Clay loam, silty clay loam.	CL	A-7	0-5	95-100	90-100	90-100	70-90	40-50	15-25
Px*, Py*. Pits											

See footnote at end of table.

Appendix A-1, continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
RcA---------------- Randolph	0-15	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	75-85	20-38	4-15
	15-25	Clay, silty clay, clay loam.	CL, CH	A-7, A-6	0-5	75-95	75-95	75-85	70-80	38-74	14-42
	25	Unweathered bedrock.									
RgB, RgC--------- Rawson Variant	0-10	Fine sandy loam	SM, SM-SC, SC	A-4	0	95-100	90-100	60-85	35-55	<25	NP-7
	10-35	Fine sandy loam, sandy loam.	SM, SM-SC, SC	A-4, A-2-4	0	95-100	90-100	50-85	25-55	<25	NP-7
	35-60	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	95-100	85-100	65-95	30-40	10-16
Rk---------------- Rensselaer	0-14	Loam-------------	CL, ML	A-4, A-6	0	100	100	90-100	70-90	27-36	4-12
	14-37	Clay loam, silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	90-100	80-100	60-80	25-40	11-16
	37-46	Sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	75-95	35-75	25-35	11-16
	46-60	Stratified fine sand to clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-2	0	95-100	90-100	60-95	20-70	<30	4-9
Sh---------------- Shoals	0-8	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	20-35	6-15
	8-23	Silt loam, loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	75-85	25-40	5-15
	23-60	Stratified silt loam to gravelly sandy loam.	ML, CL, CL-ML	A-4	0-3	90-100	85-100	60-80	50-70	<30	4-10
Sm---------------- Sloan	0-14	Silt loam--------	CL, ML, CL-ML	A-6, A-4	0	100	95-100	85-100	70-95	20-40	3-15
	14-34	Silty clay loam, loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	75-95	30-45	8-18
	34-60	Stratified gravelly sandy loam to silty clay loam.	ML, CL	A-4, A-6	0	95-100	70-100	60-95	50-90	25-40	3-15
Ud*. Udorthents											
Wo---------------- Whitaker	0-7	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	4-12
	7-37	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-80	30-47	12-26
	37-60	Stratified coarse sand to clay.	CL, SC, ML, SM	A-4	0	98-100	98-100	60-85	40-60	15-25	3-9

Appendix A-2.PHYSICAL AND CHEMICAL SOIL PROPERTIES (2)

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
ApA---------------- Aptakisic	0-9	20-27	1.15-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	5	5	1-3
	9-34	27-35	1.35-1.55	0.6-2.0	0.18-0.20	5.1-7.8	Moderate-----	0.37			
	34-60	10-25	1.40-1.60	0.6-2.0	0.14-0.22	6.1-8.4	Low-----------	0.37			
BcB2-------------- Blount	0-8	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.43	3	6	1-3
	8-24	35-50	1.40-1.70	0.06-0.2	0.12-0.19	4.5-7.8	Moderate-----	0.43			
	24-60	27-38	1.60-1.85	0.06-0.2	0.07-0.10	7.4-8.4	Moderate-----	0.43			
ChB--------------- Chelsea	0-7	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	Low-----------	0.17	5	2	.5-1
	7-60	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-8.4	Low-----------	0.17			
Ee---------------- Eel	0-7	18-27	1.30-1.50	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.37	5	5	1-3
	7-13	18-27	1.30-1.50	0.6-2.0	0.17-0.22	6.1-8.4	Low-----------	0.37			
	13-60	10-27	1.30-1.50	0.6-2.0	0.19-0.21	6.6-8.4	Low-----------	0.37			
FoA, FoB, FoC2--- Fox	0-8	10-17	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.32	4	5	1-3
	8-30	25-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	Moderate-----	0.32			
	30-60	0-2	1.30-2.20	>6.0	0.02-0.04	7.4-8.4	Low-----------	0.10			
Ge---------------- Genesee	0-18	18-27	1.30-1.50	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.37	5	5	1-3
	18-25	18-27	1.30-1.50	0.6-2.0	0.17-0.22	6.1-8.4	Low-----------	0.37			
	25-60	10-20	1.30-1.50	0.6-2.0	0.19-0.21	7.4-8.4	Low-----------	0.37			
GlB2-------------- Glynwood	0-7	16-27	1.25-1.50	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.43	3	6	1-3
	7-30	35-55	1.45-1.75	0.06-0.2	0.11-0.18	4.5-7.8	Moderate-----	0.32			
	30-60	27-36	1.65-1.85	0.06-0.2	0.06-0.10	7.4-8.4	Moderate-----	0.32			
HcA--------------- Haskins Variant	0-10	5-18	1.30-1.45	0.6-2.0	0.13-0.15	6.1-7.3	Low-----------	0.24	4	3	1-3
	10-31	17-26	1.40-1.55	0.6-2.0	0.13-0.17	5.6-7.3	Low-----------	0.32			
	31-60	28-35	1.60-1.80	0.06-0.2	0.13-0.17	6.6-8.4	Moderate-----	0.32			
HeG--------------- Hennepin	0-5	20-30	1.20-1.40	0.6-2.0	0.18-0.24	6.1-7.8	Low-----------	0.32	4	5	1-4
	5-14	18-30	1.30-1.60	0.2-0.6	0.14-0.22	6.1-7.8	Low-----------	0.32			
	14-60	18-30	1.45-1.70	0.2-0.6	0.07-0.11	6.1-8.4	Low-----------	0.32			
Ho---------------- Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	--------------	----	---	1	>70
McA, McB---------- Martinsville	0-8	8-17	1.30-1.45	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.37	5	5	1-3
	8-31	18-30	1.40-1.60	0.6-2.0	0.17-0.20	5.1-6.0	Moderate-----	0.37			
	31-47	10-25	1.40-1.60	0.6-2.0	0.12-0.14	5.1-6.5	Low-----------	0.24			
	47-60	3-23	1.50-1.70	0.6-2.0	0.19-0.21	5.1-8.4	Low-----------	0.24			
Ms---------------- Milladale	0-14	27-32	1.30-1.50	0.6-2.0	0.19-0.22	6.1-7.3	Moderate-----	0.32	4	6	4-7
	14-25	35-45	1.40-1.70	0.2-0.6	0.12-0.16	6.1-8.4	Moderate-----	0.32			
	25	---	---	---	---	---	--------------	----			
MtA, MtB, MtC----- Milton	0-7	14-27	1.30-1.50	0.6-2.0	0.18-0.23	5.1-7.3	Low-----------	0.37	4	6	1-3
	7-13	35-50	1.45-1.70	0.2-0.6	0.12-0.18	4.5-7.8	Moderate-----	0.37			
	13-24	25-45	1.40-1.70	0.2-0.6	0.12-0.16	6.1-7.8	Moderate-----	0.37			
	24	---	---	---	---	---	--------------	----			
MxC2, MxD2, MxE2- Morley	0-7	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low-----------	0.43	3	6	1-3
	7-28	35-50	1.45-1.65	0.06-0.2	0.18-0.20	5.1-7.8	Moderate-----	0.43			
	28-60	27-36	1.60-1.80	0.06-0.2	0.07-0.12	6.1-8.4	Moderate-----	0.43			
MzC3, MzD3-------- Morley	0-4	27-35	1.40-1.60	0.2-0.6	0.18-0.22	5.1-6.5	Moderate-----	0.43	2	7	1-3
	4-25	35-50	1.45-1.65	0.06-0.2	0.18-0.20	5.1-7.8	Moderate-----	0.43			
	25-60	27-36	1.60-1.80	0.06-0.2	0.07-0.12	6.1-8.4	Moderate-----	0.43			

Appendix A-2,continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
OcA, OcB: Ockley	0-8	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-6.5	Low	0.37	5	5	.5-3
	8-40	10-35	1.45-1.60	0.6-2.0	0.15-0.20	4.5-6.0	Moderate	0.37			
	40-55	20-35	1.40-1.55	0.6-2.0	0.12-0.14	5.6-7.3	Moderate	0.24			
	55-60	2-5	1.60-1.80	>20	0.02-0.04	7.4-8.4	Low	0.10			
Pa: Patton	0-8	27-35	1.15-1.35	0.6-2.0	0.21-0.23	6.6-7.3	Moderate	0.28	5	7	3-5
	8-44	27-35	1.25-1.45	0.2-0.6	0.18-0.20	6.1-7.8	Moderate	0.28			
	44-60	22-35	1.30-1.50	0.2-0.6	0.18-0.22	7.4-8.4	Moderate	0.28			
Pe: Patton	0-18	27-35	1.15-1.35	0.6-2.0	0.20-0.22	5.6-7.3	Moderate	0.28	5	7	4-6
	18-47	27-35	1.25-1.45	0.2-0.6	0.18-0.20	6.1-7.3	Moderate	0.43			
	47-60	3-30	1.20-1.50	0.2-0.6	0.06-0.14	7.4-8.4	Moderate	0.28			
Pg: Pewamo	0-12	27-40	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.3	Moderate	0.24	5	6	3-5
	12-36	35-50	1.40-1.70	0.2-0.6	0.12-0.20	5.6-7.8	Moderate	0.24			
	36-60	30-40	1.50-1.75	0.2-0.6	0.14-0.18	7.4-8.4	Moderate	0.24			
Px*, Py*. Pits											
RcA: Randolph	0-15	16-27	1.30-1.45	0.6-2.0	0.17-0.22	5.1-7.3	Low	0.37	4	6	1-3
	15-25	35-50	1.40-1.70	0.2-0.6	0.13-0.16	5.1-7.8	Moderate	0.37			
	25	---	---	---	---	---	---	---			
RgB, RgC: Rawson Variant	0-10	5-18	1.30-1.45	0.6-2.0	0.13-0.15	5.6-7.3	Low	0.24	4	3	1-3
	10-35	5-18	1.40-1.55	0.6-2.0	0.13-0.15	5.1-6.5	Low	0.24			
	35-60	28-36	1.60-1.80	0.06-0.2	0.13-0.17	6.6-8.4	Moderate	0.37			
Rk: Rensselaer	0-14	18-27	1.30-1.45	0.2-0.6	0.20-0.24	6.1-7.3	Low	0.28	5	5	2-6
	14-37	20-35	1.40-1.60	0.6-2.0	0.15-0.19	6.1-7.3	Moderate	0.28			
	37-46	20-35	1.40-1.60	0.6-2.0	0.16-0.18	6.6-7.8	Moderate	0.28			
	46-60	2-30	1.50-1.70	0.6-2.0	0.19-0.21	7.9-8.4	Low	0.28			
Sh: Shoals	0-8	18-27	1.30-1.50	0.6-2.0	0.22-0.24	6.1-7.8	Low	0.37	5	5	2-5
	8-23	18-32	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.8	Low	0.37			
	23-60	12-25	1.35-1.60	0.6-2.0	0.12-0.21	6.6-7.3	Low	0.28			
Sm: Sloan	0-14	15-27	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	Low	0.28	5	6	3-6
	14-34	22-35	1.25-1.55	0.2-0.6	0.15-0.19	6.1-8.4	Moderate	0.37			
	34-60	10-30	1.20-1.50	0.2-0.6	0.13-0.18	6.6-8.4	Low	0.37			
Ud*. Udorthents											
Wo: Whitaker	0-7	8-17	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.37	5	5	1-3
	7-37	18-30	1.40-1.60	0.6-2.0	0.15-0.19	5.1-6.0	Moderate	0.37			
	37-60	3-18	1.50-1.70	0.6-2.0	0.19-0.21	6.6-8.4	Low	0.37			

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Appendix A-3. SOIL AND WATER FEATURES(2)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
ApA—Aptakisic	C	None	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High	High	Moderate.
BcB2—Blount	C	None	---	---	1.0-3.0	Perched	Jan-May	>60	---	High	High	Moderate.
ChB—Chelsea	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Ee—Eel	C	Occasional	Brief	Oct-Jun	3.0-6.0	Apparent	Jan-Apr	>60	---	High	Moderate	Low.
FoA, FoB, FoC2—Fox	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Moderate.
Ge—Genesee	B	Occasional	Brief	Oct-Jun	>6.0	---	---	>60	---	Moderate	Low	Low.
GlB2—Glynwood	C	None	---	---	2.0-3.5	Perched	Jan-Apr	>60	---	High	High	Moderate.
HcA—Haskins Variant	C	None	---	---	1.0-2.5	Perched	Jan-Apr	>60	---	High	High	Moderate.
HeO—Hennepin	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Ho*—Houghton	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	High	High	Low.
McA, McB—Martinsville	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Ms*—Millsdale	B/D	None	---	---	+1-1.0	Perched	Jan-Apr	20-40	Hard	High	High	Low.
MtA, MtB, MtC—Milton	C	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High	Moderate.
MxC2, MxD2, MxE2, MzC3, MzD3—Morley	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
OcA, OcB—Ockley	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Pa*—Patton	B/D	None	---	---	+.5-2.0	Apparent	Mar-Jun	>60	---	High	High	Low.
Pe*—Patton	B/D	None	---	---	+.5-2.0	Apparent	Mar-Jun	>60	---	High	High	Low.

Appendix A-3 continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
Pg*: Pewamo	C/D	None	---	---	+1-1.0	Apparent	Dec-May	>60	---	High	High	Low.
Fx**, Py**. Pits												
RcA: Randolph	D	None	---	---	1.0-2.5	Perched	Jan-Apr	20-40	Hard	High	High	Moderate.
RgB, RgC: Rawson Variant	B	None	---	---	3.0-6.0	Perched	Jan-Apr	>60	---	Moderate	Low	Moderate.
Rk*: Rensselaer	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High	High	Low.
Sh: Shoals	C	Occasional	Brief	Oct-Jun	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Low.
Sm: Sloan	B/D	Frequent	Brief	Oct-Jun	0-1.0	Apparent	Nov-Jun	>60	---	High	High	Low.
Ud**. Udorthents												
Wo: Whitaker	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Moderate.

* In the "High water table--Depth" column, a plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Flooding, the temporary inundation of an area, is caused by overflowing streams, or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

Appendix A-4 CONSTRUCTION MATERIALS(2)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
ApA—Aptakisic	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
BcB2—Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
ChB—Chelsea	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Ee—Eel	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
FoA, FoB, FoC2—Fox	Good	Probable	Probable	Poor: small stones, area reclaim.
Ge—Genesee	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
GlB2—Glynwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
HcA—Haskins Variant	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
HeG—Hennepin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ho—Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
McA, McB—Martinsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ms—Millsdale	Poor: low strength, area reclaim, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
MtA, MtB, MtC—Milton	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
MxC2, MxD2—Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, too clayey.
MxE2—Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope, too clayey.
MzC3, MzD3—Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, too clayey.
OcA, OcB—Ockley	Good	Probable	Probable	Poor: small stones, area reclaim.
Pa—Patton	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

Appendix A-4, continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pe-------------------- Patton	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
Pg-------------------- Pewamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
Px*, Py*. Pits				
RcA------------------- Randolph	Poor: low strength, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, too clayey.
RgB------------------- Rawson Variant	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
RgC------------------- Rawson Variant	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Rk-------------------- Rensselaer	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Sh-------------------- Shoals	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Sm-------------------- Sloan	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ud*. Udorthents				
Wo-------------------- Whitaker	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Appendix A-5 BUILDING SITE DEVELOPMENT(2)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
ApA------ Aptakisic	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
BcB2------ Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
ChB------ Chelsea	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty.
Ee------ Eel	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
FoA------ Fox	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight----------	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
FoB------ Fox	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight----------	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Slight.
FoC2------ Fox	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: slope.
Ge------ Genesee	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
GlB2------ Glynwood	Severe: wetness.	Moderate. wetness, shrink-swell.	Severe: wetness.	Moderate: slope, shrink-swell, wetness.	Severe: frost action, low strength.	Slight.
HcA------ Haskins Variant	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
HeG------ Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ho------ Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
McA------ Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
McB------ Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.	Slight.
Ms------ Millsdale	Severe: depth to rock, ponding.	Severe: ponding.	Severe: ponding, depth to rock.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
MtA------ Milton	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.	Moderate: thin layer.
MtB------ Milton	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength.	Moderate: thin layer.

Appendix A-5,continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
MtC---------------- Milton	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.
MxC2, MxD2--------- Morley	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
MxE2--------------- Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
MzC3, MzD3--------- Morley	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
OcA---------------- Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
OcB---------------- Ockley	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Pa----------------- Patton	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Pe----------------- Patton	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Pg----------------- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Px*, Py*. Pits						
RcA---------------- Randolph	Severe: depth to rock, wetness.	Severe: wetness.	Severe: depth to rock, wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness, thin layer.
RgB---------------- Rawson Variant	Moderate: wetness.	Slight---------	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Slight.
RgC---------------- Rawson Variant	Moderate: wetness, slope.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Rk----------------- Rensselaer	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Sh----------------- Shoals	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
Sm----------------- Sloan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
Ud*. Udorthents						

Appendix A-5, continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Wo----------------- Whitaker	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.

The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Appendix A-6 SANITARY FACILITIES(2)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ApA: Aptakisic	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
BcB2: Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
ChB: Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
Ee: Eel	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
FoA, FoB: Fox	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
FoC2: Fox	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Ge: Genesee	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
GlB2: Glynwood	Severe: percs slowly, wetness.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
HcA: Haskins Variant	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
HeG: Hennepin	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Ho: Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
McA: Martinsville	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
McB: Martinsville	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
Ms: Millsdale	Severe: depth to rock, ponding, percs slowly.	Severe: depth to rock, ponding.	Severe: depth to rock, ponding, too clayey.	Severe: depth to rock, ponding.	Poor: too clayey, area reclaim, hard to pack.
MtA, MtB: Milton	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
MtC: Milton	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
MxC2, MxD2: Morley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
MxE2: Morley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
MzC3, MzD3: Morley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.

Appendix A-6,continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OcA, OcB------------ Ockley	Slight-----------	Severe: seepage.	Severe: seepage.	Slight-----------	Poor: small stones.
Pa------------------ Patton	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Pe------------------ Patton	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Pg------------------ Pewamo	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
Px*, Py*. Pits					
RcA----------------- Randolph	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness, too clayey.	Severe: wetness, depth to rock.	Poor: too clayey, area reclaim, hard to pack.
RgB----------------- Rawson Variant	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Slight-----------	Fair: wetness.
RgC----------------- Rawson Variant	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope.	Moderate: slope.	Fair: slope, wetness.
Rk------------------ Rensselaer	Severe: ponding.	Severe: ponding.	Severe: ponding, too sandy.	Severe: ponding.	Poor: too sandy, ponding.
Sh------------------ Shoals	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Sm------------------ Sloan	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Ud*. Udorthents					
Wo------------------ Whitaker	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Appendix A-7 WATER MANAGEMENT

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
ApA----------------- Aptakisic	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.
BcB2---------------- Blount	Moderate: slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
ChB----------------- Chelsea	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
Ee------------------ Eel	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
FoA, FoB------------ Fox	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy-------	Rooting depth.
FoC2---------------- Fox	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, too sandy.	Slope, rooting depth.
Ge------------------ Genesee	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
GlB2---------------- Glynwood	Moderate: slope.	Moderate: wetness, piping.	Severe: no water.	Slope, percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
HcA----------------- Haskins Variant	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, soil blowing, percs slowly.	Wetness, percs slowly.
HeG----------------- Hennepin	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, percs slowly.	Slope, droughty, percs slowly.
Ho------------------ Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Ponding, soil blowing.	Wetness.
McA----------------- Martinsville	Moderate: seepage.	Severe: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
McB----------------- Martinsville	Moderate: seepage, slope.	Severe: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Ms------------------ Millsdale	Moderate: depth to rock.	Severe: ponding, thin layer.	Severe: no water.	Depth to rock, frost action, ponding.	Depth to rock, ponding.	Wetness, depth to rock.
MtA----------------- Milton	Moderate: depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, erodes easily.	Erodes easily, depth to rock.
MtB----------------- Milton	Moderate: depth to rock. slope.	Severe: thin layer.	Severe: no water.	Deep to water	Depth to rock, erodes easily.	Erodes easily, depth to rock.
MtC----------------- Milton	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.

Appendix A-7, continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
MxC2, MxD2, MxE2, MzC3, MzD3-------- Morley	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
OcA---------------- Ockley	Moderate: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
OcB---------------- Ockley	Moderate: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Pa----------------- Patton	Slight---------	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding--------	Wetness.
Pe----------------- Patton	Slight---------	Severe: ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
Pg----------------- Pewamo	Slight---------	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding--------	Wetness.
Px*, Py*. Pits						
RcA---------------- Randolph	Moderate: depth to rock.	Severe: thin layer.	Severe: no water.	Depth to rock, frost action.	Depth to rock, wetness, erodes easily.	Wetness, depth to rock, erodes easily.
RgB---------------- Rawson Variant	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily, soil blowing.	Erodes easily, percs slowly.
RgC---------------- Rawson Variant	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily, soil blowing.	Slope, erodes easily, percs slowly.
Rk----------------- Rensselaer	Moderate: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, too sandy.	Wetness.
Sh----------------- Shoals	Moderate: seepage.	Severe: wetness, piping.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Sm----------------- Sloan	Slight---------	Severe: piping, wetness.	Severe: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Ud*. Udorthents						
Wo----------------- Whitaker	Moderate: seepage.	Severe: wetness.	Moderate: slow refill, cutbanks cave.	Frost action, cutbanks cave.	Erodes easily, wetness.	Wetness, erodes easily.

The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

Appendix A-8 RECREATIONAL DEVELOPMENT(2)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
ApA Aptakisic	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
BcB2 Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
ChB Chelsea	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Ee Eel	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
FoA Fox	Slight	Slight	Moderate: small stones.	Slight	Slight.
FoB Fox	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
FoC2 Fox	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Ge Genesee	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
GlB2 Glynwood	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: wetness, slope, percs slowly.	Moderate: wetness.	Slight.
HcA Haskins Variant	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
HeG Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ho Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
McA Martinsville	Slight	Slight	Slight	Slight	Slight.
McB Martinsville	Slight	Slight	Moderate: slope.	Slight	Slight.
Ms Millsdale	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MtA Milton	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Moderate: thin layer.
MtB Milton	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock, percs slowly.	Slight	Moderate: thin layer.
MtC Milton	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope, thin layer.
MxC2, MxD2 Morley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

Appendix A-8, continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
MxE2: Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
MzC3, MzD3: Morley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
OcA: Ockley	Slight	Slight	Slight	Slight	Slight.
OcB: Ockley	Slight	Slight	Moderate: slope.	Slight	Slight.
Pa: Patton	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Pe: Patton	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Pg: Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Px*, Py*. Pits					
RcA: Randolph	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, thin layer.
RgB: Rawson Variant	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
RgC: Rawson Variant	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
Rk: Rensselaer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Sh: Shoals	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Sm: Sloan	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Ud*. Udorthents					
Wo: Whitaker	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

Slight means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

APPENDIX B Part I

Roadway Soil Borehole Data

Map borehole #	Job borehole #	Sample Station	Offset	Sample Depth(ft.)	Classification Textural	Classification AASHTO	Percent G	Percent S	Percent M	Percent C	LL	PL	PI
					S-Project No. 608(2), SR 221								
1	1	906+00	10'Lt.	4.0- 6.0	Br. Sndy. Lm	A-1-b(0)	-79-		14	7	21	15	6
2	3	917+00	℄	4.0-10.0	Br. Clay	A-6(11)	-30-		33	37	37	18	19
				Dry Density (pct) - 122.5; Opt. moist. - 11.6; Max. Wet Dens. (pct) - 137.1									
3	6	939+60	℄	0.5-10.0	Br. Loam	A-6(9)	-41-		41	18	39	18	21
				Dry Density (pct) - 110.9; Opt. Moist. - 15.8; Max. Wet Dens. (pct) - 128.8									
4	7	943+15	℄	2.0- 4.0	Br. Sndy. Lm.	A-6(2)	-79-		18	3	21	13	8
5	9	951+20	℄	6.0- 7.5	Br. Loam	A-4(4)	-47-		49	4	NP	NP	NP
5a	9	951+20	℄	11.0-12.5	Gray Slty. Cl. Lm.	A-6(8)	- 8-		66	26	29	18	11
6	9A	956+00	℄	5.0- 6.5	Br. Sndy. Lm.	A-2-4(0)	-69-		21	10	NP	NP	NP
7	10	961+70	℄	2.0- 4.0	Br. Lm. w/tr Organic	A-7-6(12)	-32-		50	18	42	20	22
8	11	970+00	10'Rt.	8.0-10.0	Br. Sndy. Lm. w/tr. organic	A-2-4(0)	-79-		18	3	21	13	8
8a	11	970+00	10'Rt.	4.0- 6.0	Br. Lm. w/tr. organic	A-4(4)	-46-		43	11	26	16	10
9	12	975+90	22'Lt.	6.0- 8.0	Br. Sand	A-1-b(0)	-89-		7	4	NP	NP	NP
					S-Project No. 85(b), S.R. 124								
10	1	1191+00	15'Lt.	8.0-10.0	Gray Clay	A-6(7)	-34-		31	35	25	13	12
10a	1	1191+00	15'Lt.	0.5- 2.0	Br. Cl. Lm. w/tr. organic	A-7-6(12)	-37-		35	38	42	18	24
				Dry Density (pcf) - 105.7; Max. Wet Dens. - 125.1; Opt. Moist. - 18.0									
11	2	1199+55	35'Lt.	2.0- 3.0	Br. Sandy Loam	A-6(2)	58		29	13	29	18	11
12	2	1231+60	25'Rt.	0.5- 2.0	Br. Silty Loam	A-4(8)	16		69	15	22	17	5
13	8	1239+00	15'Lt.	0.5- 6.5	Br. Clay w/tr	A-6(7)	45		22	33	34	17	17
				Dry Density (pct) - 115.5; Max. Wet Dens. - 125.1; Opt. Moist. - 18.0									

PART I - Continued

Map borehole #	Map borehole #	Sample Station	Offset	Sample Depth(ft.)	Classification Textural	Classification AASHTO	Percent G S	M	C	LL	PL	PI
14	9	1243+50	65'Rt.	3.0- 4.0	Gr. Slty. Lm. w/trace organic	A-7-6(19)	-21-	63	16	55	26	29
14a	9	1243+50	65'Rt.	9.0-10.0	Gr. Sandy loam w/trace organic	A-2-6(1)	-67-	20	13	32	15	17
14b	9	1243+50	65'Rt.	15.0-16.0	Br. Sandy loam	A-2-4(0)	-73-	18	9	NP	NP	NP
15	10	1249+90	65'Lt.	3.0- 4.0	Br. Sandy loam	A-4(1)	-64-	27	9	24	16	8
16	11	1267+20	12'Lt.	3.0- 4.0	Br.e Gray Clay	A-7-6(11)	-36-	28	36	42	20	22
17	17	1305+75	℄	1.0- 2.0	Brown Sandy	A-2-4(0)	-85-	13	2	24	15	9
17a	17	1305+75	℄	14.0-15.0	Gray Silty Loam	A-6(11)	-28-	58	14	36	18	18
17b	17	1305+75	℄	20.0-21.0	Gray Sandy Loam	A-2-4(0)	-73-	14	13	18	13	5
18	18	1316+10	℄	1.0- 2.0	Br. Slty. Cl. lm. w/trace organic	A-6(12)	-25-	52	23	39	18	21
19	20	1328+00	℄	10.0-11.0	Br. Silty Loam	A-4(7)	-35-	52	13	20	15	5
20	25	1361+00	℄	10.0-11.0	Br. Sandy Loam	A-2-6(0)	-70-	17	13	28	17	11
21	28	1373+00	℄	1.0- 2.0	Tan Clay w/trace Organic	A-7-6(16)	-18-	41	41	48	23	25
22	31	1389+00	℄	0.2- 6.0	Tan Clay	A-7-6(14)	-32-	25	43	44	18	26
					Dry Density (pcf) - 108.6; Max. Wet Dew. - 126.2; Opt. moist. 15.8							
23	33	1398+50	10'R	2.5- 3.5	Mottled Gr.e Br. Clay loam	A-6(4)	-48-	25	27	30	18	12
24	39	1430+00	℄	0.5- 3.0	Brown Sandy Clay	A-6(9)	-56-	11	33	40	17	23
					Dry Density (pcf) - 105.7; Max. Wet Dens. - 125.1; Opt. moist. 18.0							
25	42	1460+00	10'R	1.0- 3.0	Brown Clay	A-7-6 (12)	-39-	22	39	44	19	25

Project F-101 (8), S.R. 9 and 37

Map borehole #	Map borehole #	Sample Station	Offset	Sample Depth(ft.)	Classification Textural	Classification AASHTO	Percent G S	M	C	LL	PL	PI
26	1	628+00	20'Ft.	1.0- 2.0	Brown Clay	A-6 (12)	-25-	32	43	36	16	20
27	2	635+85	37'Lt.	1.0- 2.0	Br. Slty. Cl. Lm.	A-7-6(20)	-13-	64	23	68	29	39
28	3	643+00	29'Rt.	1.0- 2.0	Lt. br. Sulty. Lm.	A-6(10)	-24-	60	16	30	16	14
					Dry Density (pcf) - 108.2; Opt. Moist. - 17.8; Max. Wet Dens(pcf) -127.6							

PART I - Continued

Map Borehole #	Job Borehole #	Sample Station	Offset	Sample Depth(ft.)	Classification Textural	Classification AASHTO	Percent G	S	M	C	LL	PL	PI
29	7	662+00	℄	5.0- 6.0	Gray Slty. Cl. Lm. w/some Marl & trace organic	A-7-6(14)	- 17 -		62	21	47	22	25
30	12	683+50	37'Rt.	0.8- 2.5	Bl. Slty. Cl. Lm. w/trace organic	A-7-5(20)	- 10 -		68	22	75	38	37
30a	12	683+50	37'Rt.	6.0- 7.0	Gray Sandy Loam	A-6(4)	- 55 -		29	16	31	17	14
31	13(low)	702+50	37'Rt.	1.0- 7.0	Br. Silty Clay Lm.	A-7-6(15)	- 21 -		52	27	47	23	24
32	14	710+00	37'Rt.	1.0- 5.0	Br. Silty Clay	A-7-6(18)	- 16 -		53	31	54	27	27
					Dry Density(pct)-108.2;	Opt. Moist.-17.8; Max. Wet Dens. (pct)-127.6							
33	16(high)	725+00	37'Rt.	0.5- 7.0	Lt. Br. Slty. Cl. Loam	A-7-6(15)	- 20 -		54	26	47	24	23
34	18	734+65	37'Rt.	3.0- 4.0	Dk. Br. Sndy. Loam w/trace organic	A-6(3)	- 58 -		27	15	37	22	15
35	22	750+00	40'Lt.	6.0- 8.0	Brown Clay	A-6(5)	- 43 -		10	47	27	16	11
36	25	774+00	37'Lt.	0.0- 1.0	Br. Silty Loam	A-6(9)	- 28 -		55	17	33	19	14
37	28	785+00	37'Lt.	3.0- 4.0	Br. Clay Loam	A-7-6(14)	- 40 -		32	28	47	16	31
38	32	817+00	37'Rt.	1.5- 2.5	Br. & Gray Loam	A-6(8)	- 34 -		48	14	33	20	13
39	35	833+80	37'Rt.	2.0- 4.0	Br. Sandy Loam	A-6(8)	- 56 -		25	19	32	17	15
39a	35	833+80	37'Rt.	14.0-16.0	Brown Sand	A-2-4(0)	- 84 -		11	5	24	15	9
40	38	845+75	37'Rt.	2.0- 4.0	Dk. Br. Sand 2/trace organic	A-2-4(0)	- 82 -		--	--	28	19	9
40a	38	845+75	37'Rt.	12.0-14.0	Brown Sand	A-1-a(0)	- 92 -		--	--	NP	NP	NP
41	42	870+60	37'Rt.	1.0- 2.0	Lt. Br. Clay Lm.	A-7-6(13)	- 29 -		44	27	46	25	21
					Dry Density(pct)-104.2;	Opt. moist.-19.0; Max. wet dens.(pct)-124.8							
42	46(high)	891+50	80'Lt.	6.0- 7.0	Brown Clay Loam	A-6(9)	- 32 -		43	25	32	16	16
43	48	906+0 0	37'Lt.	1.0- 2.0	Silty Clay Loam	A-6(10)	- 23 -		55	22	33	17	16
43a	48	906+00	37'Lt.	7.0- 8.0	Gray Clay	A-6(10)	- 11 -		43	46	30	16	14
44	51	912+00	165'Lt.	0.0- 1.0	Brown Loam	A-4(4)	- 47 -		40	13	27	18	9
44a	51	912+00	165'Lt.	7.0- 8.0	Mottled Br. & Bl. Sandy Loam	A-2-6(2)	- 66 -		15	19	40	20	20

PART I - Continued

Map borehole #	Map borehole #	Sample Station	Offset	Sample Depth(ft.)	Classification Textural	AASHTO	Percent G S	M	C	LL	PL	PI
44b	51	912+00	165'Lt.	14.0-15.0	Brown Sand	A-1-6(0)	-95-	--	--	NP	NP	NP
45	54	928+40	37'Rt.	0.0- 1.0	Brown Silty Loam	A-6(11)	-10-	26	14	40	22	18
				F-Project No. 888(3), S.R. 37 and 9 Bypass								
46	4	118+00	15'Lt.	3.5- 6.5	Mott. Gr. & Yellow Silty Clay	A-6(9)	- 5-	53	42	31	19	12
46a	4	118+00	15'Lt.	6.5-11.0	Gray Clay	A-6(10)	- 8-	44	48	32	18	14
47	5	121+00	15'Rt.	0.0- 2.5	Dk. Gray Sndy. Lm. w/ little Organ	A-2-7(3)	-74-	14	12	74	39	35
48	8	130+00	37'Rt.	11.5-13.0	Gray Clay	A-6(8)	-29-	40	31	27	16	11
49	10	136+00	37'Rt.	6.5- 8.0	Br. Sandy Loam	A-2-7(1)	-73-	16	11	41	21	20
50	12	142+00	37'Rt.	0.5- 4.0	Yellow Clay	A-4(5)	-44-	23	33	29	21	8
51	20	166+00	37'Rt.	8.0-15.5	Lt. Br. Clay	A-6(10)	-27-	40	33	31	17	14
52	22	172+00	37'Rt.	11.5-14.0	Mott-yel.-Gray/silt	A-4(8)	- 7-	85	8	23	19	4
53	25	181+00	37'Rt.	10.5-15.0	Br. Clay Loam	A-6(6)	-42-	34	24	28	16	12
54	29	193+00	37'Rt.	2.5- 6.0	Dk. Br. Clay Loam	A-6(11)	-31-	46	23	40	20	20
55	31	199+00	37'Rt.	4.0- 4.5 refusal @ 4.5'	Lt. Br. Silty Loam	A-6(10)	-22-	61	17	35	21	14
56	35	211+00	20'Lt.	1.0- 3.0 refusal @ 5.5'	Brown Clay	A-7-6(20)	-19-	48	33	62	23	39
57	42	232+00	37'Rt.	0.0- 3.0	Bl. Silty Loam	A-7-5(11)	-25-	61	14	51	38	13
57a	42	232+00	37'Rt.	4.5- 7.5 refusal @ 7.5'	Yel. Silty Cl. Loam	A-4(8)	-18-	61	21	31	22	9
58	49	252+50	20'Lt.	0.0- 5.0 refusal @ 6.0'	Reddish Br. Sndy. Lm.	A-4(3)	-54-	34	12	32	22	10
59	B-5	256+11	25'Rt.	lmst. @ elev. 688'a.m.s.l.	Alluvium to bedrock	A-4 to A-6	------	------	------	------	------	------
60	52	200+80 (new line)	20'Rt.	4.0- 6.0 refusal @ 6.0'	Br. Sandy Loam	A-4(0)	-65-	30	5	21	17	4

PART I - Continued

					Classification		Percent						
Borehole #	Borehole #	Station	Offset	Depth(ft.)	Textural	AASHTO	G	S	M	C	LL	PL	PI
				F-Project No. 888(1), S.R. 37 Bypass									
61	MZ002	204+00	37'Rt.	0.0- 2.0	Sndy Cl. Loam	A-4(1)	-60-		18	22	NP	NP	NP
61a	MZ002	204+00	37'Rt.	2.0- 4.0	Sndy Clay	A-4(3)	-52-		16	32	23	17	6
				refusal @ 8.0'									
62	MZ011	216+00	37'Rt.	38.0-40.0	Sand some gravel	A-1-b(0)	87		1	12	NP	NP	NP
63	MZ013	221+00	37'Rt.	2.5- 4.0	Sndy. Cl. Lm w/ little gravel	A-4(1)	60		16	24	16	14	2
64	MZ200	240+00	37'Rt.	0.0- 1.0	Silty Clay	A-4(8)		8	54	38	27	23	4

PART I - Continued

Map Borehole #	Job Borehole #	Sample Station	Offset	Sample Depth(ft.)	Classification Textural	Classification AASHTO	Percent G	S	M	C	LL	PL	PI
64a	MZ200	240+00	37'Rt.	2.0- 3.0	Clay, tr. gravel	A-6(9)	- 25 -		25	50	29	17	12
65	MZ108	283+00	℄	2.0- 4.0	Peat	--	- 52 -		22	26	72	59	13
65a	MZ108	283+00	℄	6.0- 8.0	Clay	A-4(8)	- 1 -		42	57	47	27	20
65b	MZ108	283+00	℄	12.0-14.0	Clay, tr. gravel	A-4(8)	- 24 -		27	49	25	15	10
66	MZ215	300+00	37'Rt.	0.0- 1.0	Clay, tr. gravel	A-4(8)	- 11 -		37	52	29	22	7
66a	MZ215	300+00	37'Rt.	2.0- 3.0	Clay, tr. gravel	A-6(11)	- 17 -		31	52	36	18	18
67	MZ084	354+50	135'Lt.	2.0- 4.0	Clay, tr. gravel	A-6(8)	- 26 -		28	46	26	15	11
68	MZ033	369+00	37'Lt.	2.0- 4.0	Clay, tr. gravel	A-4(7)	- 30 -		21	49	24	15	9
69	MZ035	375+00	37'Lt.	4.0- 6.0	Peat	--	- 21 -		37	42	50	39	11
69a	MZ035	375+00	37'Lt.	10.0-12.0	Clay	A-6(10)	- 4-		43	53	38	23	15
70	MZ040	386+90	37'Lt.	2.0- 4.0	Clay, tr. gravel	A-6(8)	- 27 -		19	54	28	16	12
71	MZ045	393+65	75'Lt.	2.0- 4.0	Peat	--	- 34 -		30	36	81	61	20
71a	MZ045	393+65	75'Lt.	18.0-20.0	Clay, tr. gravel	A-4(7)	- 28 -		21	51	25	16	9
72	MZ052	441+00	37'Lt.	14.5-16.0	Sandy loam w/little gravel	A-2-4(0)	- 74 -		7	10	NP	NP	NP
73	MZ054	447+00	37'Lt.	0.8- 2.0	Sandy Clay w/little gravel	A-6(3)	- 52 -		14	34	26	15	11
74	MZ056	452+00	37'Lt.	4.0- 6.0	Sandy Clay loam	A-2-4(0)	- 71 -		4	25	16	14	2
75	MZ177	469+30	21'Rt.	2.0- 4.0	Clay, Little gravel	A-6(8)	- 37 -		12	51	31	16	15
76	MZ160	475+35	15'Rt.	4.0- 6.0	Sandy clay, tr. gravel	A-6(2)	- 62 -		0	38	31	13	18
			Project I-69-4(25) 86										
77	--(high)	103+00	42'Rt.	2.0- 4.0	Brown Clay	A-6(7)	30		20	50	27	16	11
77a	--	103+00	42'Rt.	8.0-10.0	Brown Clay	A-6(9)	14		24	62	25	13	12
78	--(low)	108+00	42'Lt.	4.0- 6.0	Brown Clay	A-6(10)	23		33	44	32	18	14
79	--(high)	111+00	42'Rt.	0.0- 2.0	Brown Clay	A-6(13)	22		31	47	40	18	22
80	--	116+00	℄	3.0- 5.0	Brown Clay	A-6(7)	31		35	34	24	13	11
80a	--	116+00	℄	13.0-15.0	Br. Sndy. Cl. Lm.	A-4(2)	55		24	21	30	25	5
81	--(high)	129+00	42'Rt.	0.0- 2.0	Brown Clay	A-6(10)	32		35	33	35	16	19
82	--(low)	140+00	42'Lt.	2.0- 4.0	Brown Clay	A-7-6(17)	17		33	50	30	25	5
82a	--(low)	140+00	42'Lt.	9.5-11.5	Brown-Gray Clay	A-6(9)	26		30	44	26	12	4
83	--	152+00	42'Lt.	0.0- 2.0	Black Clay	A-7-6(20)	16		34	50	61	25	36
83a	--	152+00	42'Lt.	10.0-12.0	Gray Clay	A-6(9)	[illegible]		34	42	27	14	13

PART I - Continued

Map Borehole #	Job Borehole #	Sample Station	Offset	Sample Depth(ft)	Classification Textural	Classification AASHTO	Percent G	Percent S	Percent M	Percent C	LL	PL	PI
84	--	164+00	42'Lt.	0.0- 2.0	Black Clay	A-7-6(18)		9	43	48	54	26	28
85	-(low)-	179+00	42'Ft.	2.0- 4.0	Brown Clay	A-7-6(16)		11	41	48	48	23	25
86	--	185+00	42'Rt.	1.0- 3.0	Brown Clay	A-7-6(20)		13	41	46	59	27	32
86a	--	185+00	42'Rt.	5.0- 7.0	Brown Clay	A-6(11)		26	36	38	33	17	16
86b	--	185+00	42'Rt.	11.0-13.0	Gray Clay	A-6(11)		22	31	47	36	18	18
86c	--	185+00	42'Rt.	13.0-15.0	Gray Silty loam	A-4(0)		46	52	2	NP	NP	NP
87	-(low)-	200+00	50'Rt.	1.0- 3.0	Black Silty Clay	A-7-5(17)		4	62	34	80	57	23
87a	-(low)-	200+00	50'Rt.	3.0- 5.0	Brown-gray	A-4(8)		7	42	51	27	17	10
88	-S.W. Lac.-	203+00	42'Rt.	0.0- 2.0	Black Clay	A-7-6(19)		4	48	48	55	24	31
89	--	215+00	42'Rt.	0.0- 2.0	Brown Clay	A-7 6(15)		14	40	46	45	19	26
89a	--	215+00	42'Rt.	4.0- 6.0	Brown Clay	A-7-6(18)		18	35	47	51	19	32
90	--	230+00	42'Lt	0.0- 2.0	Brown Clay	A-7-6(17)		12	37	51	51	23	28
90a	--	230+00	42'Lt.	2.0- 4.0	Brown Clay	A-6(10)		28	32	40	36	19	17
91	(high)--	245+00	42'Rt.	1.0- 3.0	Brown Clay	A-7-6(14)		8	37	55	45	22	23
91a	--	245+00	42'Rt.	3.0- 5.0	Brown Clay loam	A-6(6)		37	36	27	26	15	11
91a	--	245+00	42'Rt.	9.0-11.0	Brown Clay	A-6(9)		25	34	41	29	16	13
91c	--	245+00	42'Rt.	15.0-17.0	Gray Clay	A-7-6(15)		10	25	65	46	20	26
92	-(low)-	251+00	42'Rt.	0.0- 2.0	Brown Clay	A-7-6(13)		17	39	44	41	19	22
93	-(low)-	263+00	42'Rt.	0.0- 2.0	Brown-Gray Clay	A-7-6(19)		10	42	48	54	20	34
93a	-(low)-	263+00	42'Rt.	4.0- 6.0	Brown Clay	A-6(10)		23	35	42	35	21	14
94	--	278+00	42'Lt.	0.0- 2.0	Black Clay	A-7-6(19)		11	39	50	53	21	32
94a	--	278+00	42'Lt.	2.0- 4.0	Brown Clay	A-7-6(18)		9	46	45	52	24	28
95	--	287+00	42'Rt.	1.0- 3.0	Brown Clay loam	A-6(6)		47	25	28	38	22	16
95a	--	287+00	42'Rt.	5.0- 7.0	Gray Clay	A-7-6(13)		14	32	54	42	21	21
95b	--	287+00	42'Rt.	9.0-11.0	Brown Clay loam	A-4(5)		40	33	27	19	14	5
95c	--	287+00	42'Rt.	15.0-17.0	Gray Clay	A-6(9)		19	37	44	28	16	12
96	--	302+00	42'Lt.	0.0- 2.0	Brown Clay	A-7-6(20)		13	49	38	58	26	32
96a	--	302+00	42'Lt.	4.0- 6.0	Brown Clay	A-7-6(13)		22	33	45	42	20	22
				S-Project No. 63 (4) S.R. 114									
97	--	10+00	16'Lt.	0.0- 0.7	Clay	A-7-6(10)	1	28	39	32	40	25	15
97a	--	10+00	16'Lt.	0.7- 3.0	Clay	A-7-6(13)	0	27	34	39	42	20	22
97b	--	10+00	16'Lt.	3.0- 4.5	Clay	A-6(6)	7	30	31	32	27	16	11
98	--	148+00	15'Rt.	0.8- 4.5	Clay	A-6(8)	0	32	32	36	28	17	11
99	--	158+00	15'Lt.	1.1- 6.0	Clay	A-6(12)	0	22	31	47	40	19	21

PART I - Continued

Map Borehole #	Job Borehole #	Sample Station	Offset	Sample Depth(ft.)	Classification: Textural	Classification: AASHTO	Percent: G	S	M	C	LL	PL	PI
100	--	309+00	25'Lt.	0.0- 1.4	Peat	--	0	30	37	33	70	42	28
100a	--	309+00	25'Lt.	1.4- 6.8	Marly Peat	--	0	29	45	26	33	21	12
101	--	379+00	13'Lt.	2.6- 6.8	Marly Peat	--	11	25	36	28	42	28	14
			M-Project No. 1337, Old U.S. 24										
102	RB-1	3+25	37'Rt.	3.0- 4.5	Clay loam	A-7-6(25)	0	30	40	30	62	26	36
103	RB-6	27+50	52'Lt.	3.0- 4.5	Sandy loam	A-4(0)	16	46	24	14	NP	NP	NP
103a	RB-6	27+50	52'Lt.	1.5- 2.0	Clay	A-7-6(20)	0	15	45	40	43	21	22
104	RB-8	61+00	℄	4.5- 6.0	Clay loam	A-4(1)	2	47	29	22	28	20	8
			Max. Dry Density - 106.3(pcf); Opt. Moisture content - 18.5										
			F-Project No. 158 - 1(1), S.R. 224 over L. Wabash River										
105	TB-1	11+03.5	33'Lt.	Silt and sand to dolomite @ 2.0'; RQD = 70%									
106	TB-2	11+59	36.5'Rt.	Sandy gravel w/lmst. boulders to dolom. @ 2.5; RQD = 70%									
107	TB-3	12+87	13'Lt.	6.0- 7.5	Loam	A-4(0)	5.2	44.0	40.3	10.5	NP	NP	NP
107a	TB-3	12+87	13'Lt.	13.5-15.0	Loam	A-6(4)	0.6	40.1	45.3	14.0	31.8	21.0	10.8
			Gray, hard, massive, fractured dolomite @ 18.0; RQD = 33%										
108	TB-4	13+70	33'Rt.	Gray, soft to dolomite @ 1.9'; RQD=30%									
			RS-Project No. 3055(1), S.R. 218 over Salamonie River										
109	RB-1CBR	552+00	℄	2.5- 4.0	Clay loam	A-6(9)	3.8	25.3	43.1	27.8	32.3	17.3	15.0
				Opt. moist.- 14.9; max. dry dens.-114.7(pcf); max. wet dens.-132.0(pcf)									
109a	RB-1	552+00	℄	13.5-15.0	Sandy Gravel	A-1-a(0)	57	29.4	-	13.6-	NP	NP	NP
110	TB-1	553+15	30.0'Lt.	5.0-6.5	Clay loam	A-6(6)	0.0	37.9	36.1	26.0	32.9	19.8	13.6
110a	TB-1	553+15	30.0'Lt.	15.0-16.0	Sandy loam	A-4(0)	15.1	45.1	29.1	10.7	NP	NP	NP
110b	TB-1	553+15	30.0'Lt.	25.0-26.5	Sandy loam	A-4(0)	16.4	42.2	41.4	0.0	15.2	12.2	3.0
110c	TB-1	553+15	30.0'Lt.	30.0-31.5	Silty loam	A-4(5)	5.7	20.5	66.5	13.3	25.7	15.3	10.4
			Auger refusal @ 37.5'; lmst./dolom. bedrock w/RQD = 30%; artesian condition										

PART I - Continued

Map borehole #	Job borehole #	Sample Station	Offset	Sample Depth(ft)	Classification Textural	Classification AASHTO	Percent G	Percent S	Percent M	Percent C	LL	PL	PI
111	TB-2	554+18.5	30'Rt.	5.0- 6.5	Sandy Loam w/some gravel	A-2-4(0)	22.9	42.8	27.9	6.4	14.8	12.7	2.1
111b	TB-2	554+18.5	30'Rt.	10.0-11.5	Gravelly Sand	A-1-6(0)	44.5	52.9	--2.6--		NP	NP	NP
				Auger refusal @ 17.8'; dolomite bedrock a/RQD=83%									
112	TB-3	555+91	25'Rt.	6.0- 7.5	Clay loam	A-6(4)	3.4	36.7	41.7	22.2	27.6	16.6	11.0
112a	TB-3	555+91	25'Rt.	13.5-15.0	Sandy Gravel	A-2-4(0)	50.1	33.3	12.6	4.0	26.6	19.7	6.9
112b	TB-3	555+91	25'Rt.	28.5-29.5	Sandy Loam w/some gravel	A-1-6(0)	26.8	50.6	20.6	2.0	NP	NP	NP
				Refusal @ 32.5'; 1.3' of weathered shale over dolomite w/RQD=78%									
			RS-Project No. 3335(2), S.R. 105 over Pony Creek										
115	TB-3	50+36	11'Rt.	3.5- 5.0	Clay Loam	A-6(11)	4	25	42	29	34	14	19
114	TB-2	49+87	30'Rt.	23.5-25.0	Sand	A-3(0)	0	94	---0---		NP	NP	NP
114a	TB-2	49+87	30'Rt.	38.5-40.0	Clay	A-6(7)	2	20	47	31	25	13	12
113	TB-1	49+64	11'Lt.	8.5-10.0	Gravelly Sand	A-1-6(0)	24	64	--12---		NP	NP	NP
			F-Project 101 (12) P.E., SR. 37 e 9 North of Mt. Etna										
116	5	958+00	37'Rt.	1.0- 2.5	Clay	A-7-5(44)	- 7-		46	47	70	31	39
116a	5	958+00	37'Rt.	2.5- 3.5	Clay	A-7-6(55)	- 2-		46	52	76	29	47
116b	5	958+00	37'Rt.	3.5- 4.5	Silty Clay	A-7-6(22)	- 2-		55	43	45	26	19
117	6	961+00	37'Rt.	0.0- 0.7	Silty Clay loam	A-6(10)	-15-		56	29	35	23	12
118	7	964+22	37'Rt.	2.5-10.0	Clay	A-4(5)	-28-		34	38	26	16	10
119	24	1037+00	37'Rt.	1.0- 2.0	Silty Clay	A-7-6(25)	-13-		51	36	48	21	10
119a	24	1037+00	37'Rt.	4.0- 5.0	Clay	A-7-6(28)	-11-		44	45	51	22	29
120	40	1101+25	37'Rt.	0.0- 1.0	Silty Clay loam	A-6(11)	-17-		54	29	35	21	14
120a	40	1101+25	37 Rt.	7.0- 8.0	Clay	A-6(6)	-27-		36	37	29	18	11
			ST-Project No. 3335(1), S.R. 105 over Silver Creek										
121	TB-3	100+03	22'Lt.	1.0- 2.5	Sandy loam	A-2-4(0)	0.3	75.2	21.9	2.6	NP	NP	NP
121a	TB-3	100+03	22'Lt.	3.5- 5.0	Gravelly Sand	A-1-b(b)	36.5	56.5	-- 7.0--		NP	NP	NP
				Refusal @ 13.0; Limestone w/RQD of 15-25									
122	TB-4	100+23	18'Rt.	8.5-10.0	Silty loam	A-4(5)	3.5	22.7	54.4	19.4	24.8	15.3	9.5
122a	TB-4	100+23	18'Rt.	13.5-15.0	Silty Clay	A-6(16)	0.6	4.6	52.0	42.8	37.1	20.6	16.5
				Refusal @ 16.2'; Limestone w/RQD of 15%									

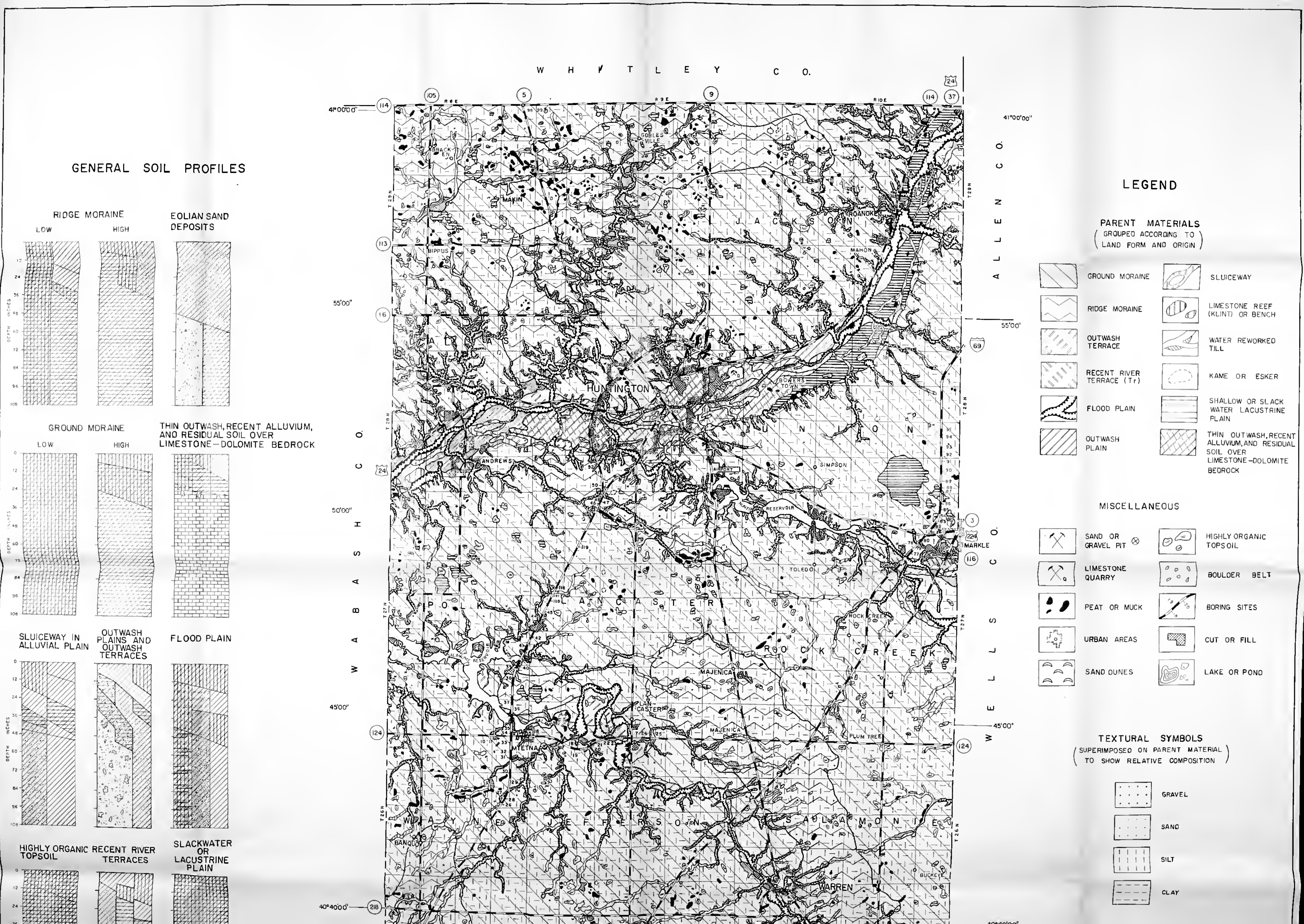
APPENDIX B Part II

Miscellaneous Information

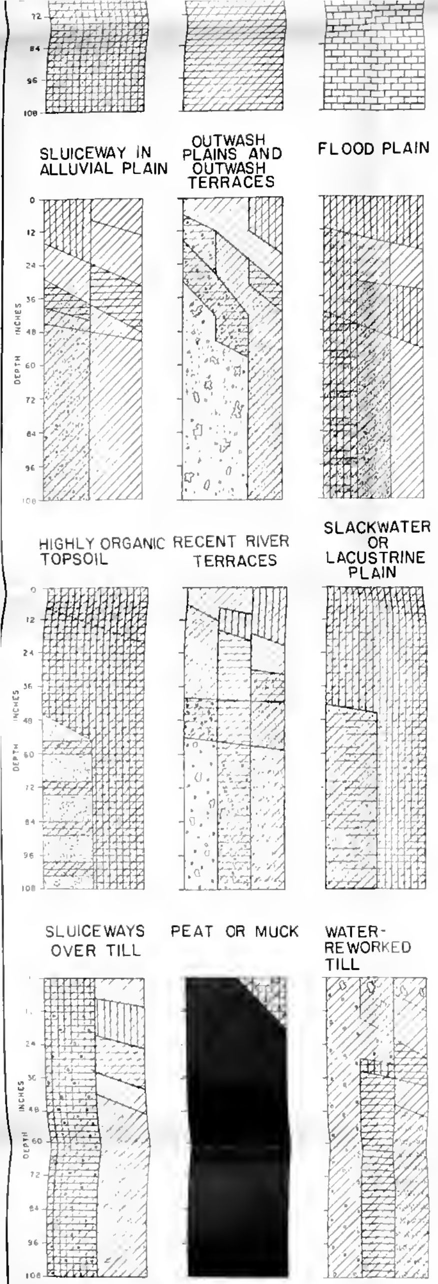
Soil Survey Project	Notes
F-Project 888(3), S.R. 37 over Wabash River.	Limestone encountered @ 1.0 - 7.0 ft.; overburden generally composed of sandy loam (A-4) surface soil and silty clay-loam (A-6) subsoil. Parent materials are thin outwash or recent alluvium over residual limestone soil or limestone bedrock. Elevation of bedrock approximately 688' a.m.s.l.
F-Project 888 (1), S.R. 37 Bypass north of Huntington.	Sounding show depth of peat or muck in small bogs north of Huntington as much as 22.0 ft. General profile consists of: a) 0'-3' of clay with trace gravel; b) 3'-6' organic soil; c) 6'-14' of muck, and d) clay with trace gravel beneath 14.0'. Ground moraine soil types using the AASHTO classification system shared the following distribution along the S.R. 37 Bypass north of Huntington: Soil Type — Percent A-1-6 — 8 A-2-4 — 6 A-4 — 40 A-6 — 40 A-7-6 — 6 (peat)
F-Project 3335 (1), S.R. 105 over Silver Creek.	Limestone encountered at depth of 13.0 to 20.0 feet. General profile consists of a sandy loam (A-2-4) surface soil which is underlain at about 3 feet by alluvial sands and gravels (A-1-6) to a depth of about 5 to 13 feet. Silty loam (A-4) or silty clay (A-6) - till overlies limestone bedrock.

Part II, Continued

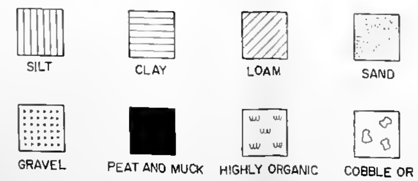
Soil Survey Project	Notes
Structure No. 221-35-6042, S.R. 221 over Wabash River.	Limestone encountered as shallow as 3 feet and up to 23 feet deep. General soil profile consists of 1.0 feet of a sandy loam surface soil which is underlain by silty loam or silty clay-loam to limestone bedrock.
Structure No. 221-D-5451, S.R. 221 over Salamonie River	Limestone encountered at depths of from 7.0 to 25.0 feet. General soil profile consists of 1.0 to 3.5 feet of a sandy loam surface soil which is underlain by silty loam or sandy loam alluvial material. The surface or subsoil is underlain by weathered, residual limestone which lies on the limestone bedrock.
F-Project 101 (8), S.R. 9 over Salamonie River.	General soil profile consists of 1.0 to 3.0 feet of a fine sand, silt loam, or sandy loam surface soil which is underlain by alluvial sand and gravel and sandy loam parent materials. Silty loam or silty clay-loam till underlies the alluvial material.
ST-Project No. 3635 (B), S.R. 124 over Brook Creek	Limestone encountered at 12.5 to 15.5 feet of depth with RQD of 0%-15%. General soil profile consists of 0.3 feet of a silty loam surface soil which is underlain by a sandy clay, silty clay, or silty loam subsoil to 7.0. Silty clay-loam or silty clay-till overlies limestone bedrock.

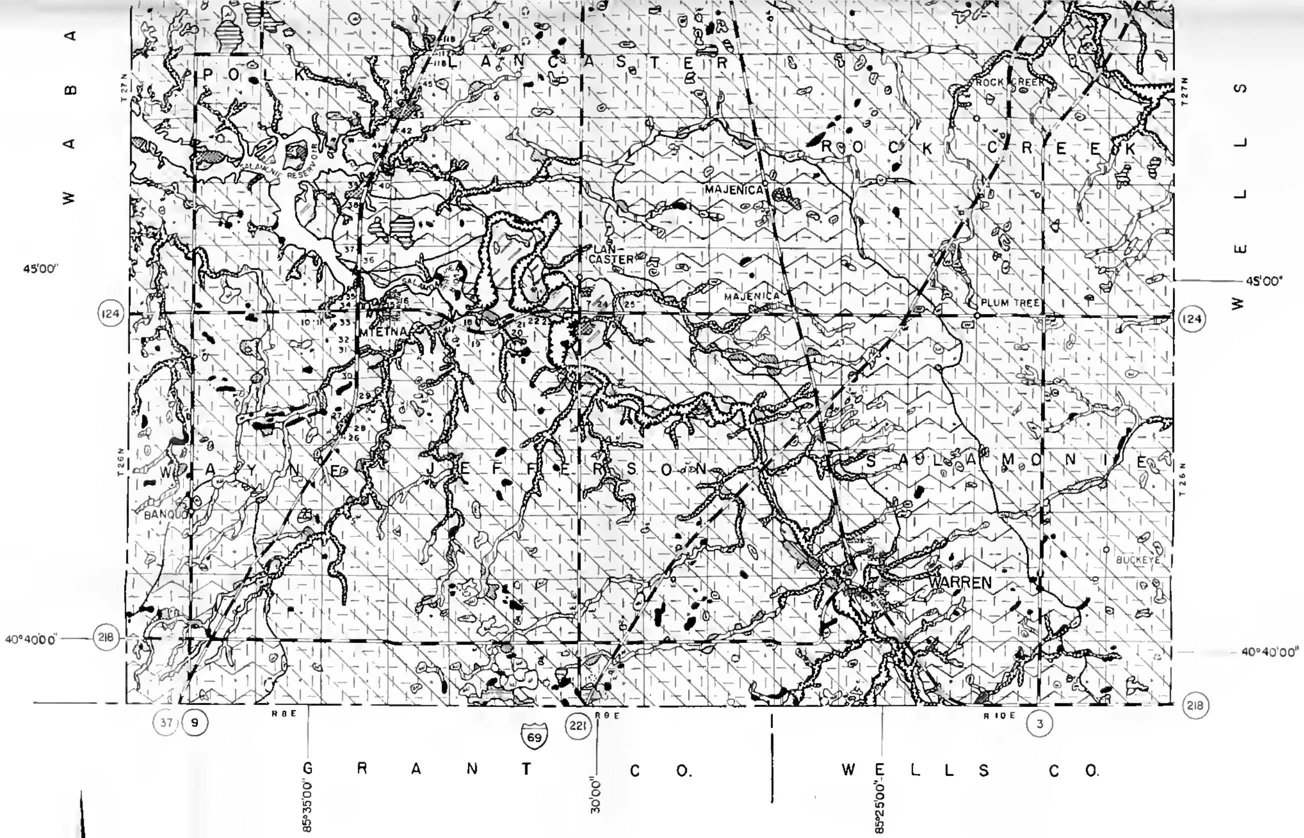


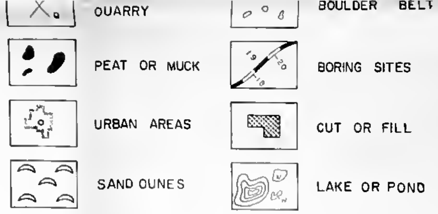
GENERAL SOIL PROFILES
RIDGE MORAINE
LOW
HIGH
EOLIAN SAND DEPOSITS
GROUND MORAINE
LOW
HIGH
THIN OUTWASH, RECENT ALLUVIUM, AND RESIDUAL SOIL OVER LIMESTONE-DOLOMITE BEDROCK
SLUICEWAY IN ALLUVIAL PLAIN
OUTWASH PLAINS AND OUTWASH TERRACES
FLOOD PLAIN
HIGHLY ORGANIC TOPSOIL
RECENT RIVER TERRACES
SLACKWATER OR LACUSTRINE PLAIN
DEPTH INCHES
W H I T L E Y CO.
ALLEN CO.
WABASH CO.
WELLS CO.
41°00'00"
55'00"
50'00"
45'00"
40°40'00"
R 8 E
R 9 E
R 10 E
T 29 N
T 28 N
T 27 N
T 26 N
JACKSON
UNION
POLK
LANCASTER
ROCK CREEK
WAYNE
JEFFERSON
SALAMONIE
HUNTINGTON
ROANOKE
MAHON
BIPPUS
MAKIN
ANDREWS
SIMPSON
MARKLE
TOLEDO
BOWERS TOWN
AIRPORT
MAJENICA
LANCASTER
MT ETNA
PLUM TREE
WARREN
BUCKEYE
BANQUO
LEGEND
PARENT MATERIALS
(GROUPED ACCORDING TO LAND FORM AND ORIGIN)
GROUND MORAINE
RIDGE MORAINE
OUTWASH TERRACE
RECENT RIVER TERRACE (Tr)
FLOOD PLAIN
OUTWASH PLAIN
SLUICEWAY
LIMESTONE REEF (KLINT) OR BENCH
WATER REWORKED TILL
KAME OR ESKER
SHALLOW OR SLACK WATER LACUSTRINE PLAIN
THIN OUTWASH, RECENT ALLUVIUM, AND RESIDUAL SOIL OVER LIMESTONE-DOLOMITE BEDROCK
MISCELLANEOUS
SAND OR GRAVEL PIT
HIGHLY ORGANIC TOPSOIL
LIMESTONE QUARRY
BOULDER BELT
PEAT OR MUCK
BORING SITES
URBAN AREAS
CUT OR FILL
SAND DUNES
LAKE OR POND
TEXTURAL SYMBOLS
(SUPERIMPOSED ON PARENT MATERIAL TO SHOW RELATIVE COMPOSITION)
GRAVEL
SAND
SILT
CLAY



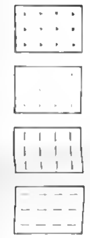
TEXTURAL SYMBOLS FOR SOIL PROFILES







TEXTURAL SYMBOLS
(SUPERIMPOSED ON PARENT MATERIAL TO SHOW RELATIVE COMPOSITION)



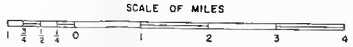
ENGINEERING SOILS MAP
HUNTINGTON COUNTY
INDIANA

PREPARED FROM

JOINT HIGHWAY RESEARCH PROJECT
AT
PURDUE UNIVERSITY

1985

SCALE OF MILES



PREPARED UNDER THE SUPERVISION OF E. M. GEFELL AND R. D. MILES

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